Pacioli 20

Complex farms and sustainability in farm level data collection

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Complex farms and sustainability in farm level data collection

Hans Vrolijk (ed.)

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The international Pacioli network shares knowledge on the management and use of agricultural micro-economic databases (such as the Farm Accountancy Data Network in Europe). Each year, LEI Wageningen UR organises a Pacioli workshop in close cooperation with a local organiser. The 20th Pacioli workshop took place in Rome, Italy, in October 2012.

Photo cover: Hans Vrolijk

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Preface

For the 20th time, LEI organised the yearly Pacioli workshop. This year it took place in Rome, Italy, from 30 September to 3 October 2012.

There were a record number of 48 participants from EU countries, non-EU countries such as Switzerland and Norway, candidate countries and from international organisations such as OECD, USDA, FAO and the European Commission. They discussed innovations and developments in the collection and use of farm level data. Important topics were the measurement of sustainability indicators, the specific problems of collecting information on large complex farms and the use of data for policy analysis and research.

The Italian research institute INEA hosted the meeting and took care of the local organisation. LEI was responsible for organising the content of the programme and chairing the meetings. We thank Concetta Cardillo and Antonella Bodini for the local organisation of the workshop.

L.C. van Staalduinen MSc
Managing Director LEI Wageningen UR

1 Introduction

1.1 20th Pacioli workshop

In cooperation with INEA, LEI part of Wageningen UR organised the 20th pacioli workshop which took place between the 30th of September and the 3rd of October 2012, in Rome.

1.2 Programme of the 20th Pacioli workshop

Sunday, 30th of September 2012

21.00 Get together for informal drink

Monday, 1st of October 2012

08.45 *Opening*
Italian welcome by prof. Alberto Manelli, General Director of INEA
and Dr. Luca Cesaro, Head of Unit 1 (RICA/FADN)…

Introduction Workshop by Hans Vrolijk

09.15 *Paper Session I*
Performance analysis

Eduard Matveev - Economic performance and profitability of organic farms in Estonia

Shingo Kimura - Cross country comparison of farm performance

Werner Kleinhanss - Productivity and efficiency of dairy farms

Andrew Woodend - Distribution of performance and factors associated with better efficiency

Rima Daunyte and Arvydas Kuodys - Lithuanian dairy farms business - evaluation of the economic performance indicators

11.00 Break

11.30 *Paper Session II*
Complex farms

Mary Ahearn - Challenges in Collecting Data from Complex Farm Operations: Review of Perspectives from an International Conference

Henrik Pedersen - How to deal with large complex farms in Denmark

Valdat Bratka - Impact of large complex farms on the design of a representative sample.

12.30 Lunch

13.45 *Paper Session III*
Sustainability

Thia Hennessey - The use of data for policy analysis and the measurement of sustainability

Lech Goraj - 'The effect of environmental sustainability on the economic cost of farm milk and wheat

	Nathalie Delame, - Econometric estimation of fertilizer use for wheat and other crops
	Silvia Coderoni - Using FADN data to estimate agricultural GHG emissions at farm level
	Hans Vrolijk - Sustainability in the Pig sector; analyses with FADN data
15.45	Break
16.00	*Workgroup Session I*
	How to deal with large / complex farms in FADN
17.30	Break
18.00 - 19.40	*Paper Session IV*
	Assets in Agriculture
	Pieter Willem Blokland - Investments in dairy farming
	Concetta Cardillo - Machinery and equipment in Italian agriculture
	Sampling and typology
	Ann-Marie Karlsson - Impact of differences in applying the SO-typology on FADN-farms in FADN and in FSS for the weighting of farms
	Andreas Roesch - Random sampling - does it really improve representativity?
20.00	Dinner

Tuesday, 2nd of October 2012

8.45	*Paper Session V*
	Development of farm data collection systems
	Namig Shalbuzov - Farm Data and Monitoring System in Azerbaijan
	Cemre Ozcanli- Development of FADN in Turkey
	Hakile Xhaferi - Status of FADN in Kosovo,
	Kristijan Jelakovic - EU conformity of the Croatian FADN
	Alexander Musalevski - FADN in Macedonia
	Piotr Bajek and Eva Nagy - Changes in the EU farm return
10.45	Break
11.00	*Workgroup Session 2*
	Challenges in the development of FADN
	Challenges in collecting sustainability indicators in FADN
12.30	Lunch
13.30 -22.00	*Excursion with dinner*

Wednesday, 3rd of October 2012

8.45 *Paper Session VI*

Economic analysis

Stijn Jourquin - Cost and profitability analysis for wheat, barley and maize

Murat Aslan - Economic analysis with Turkish FADN data

Torbjorn Haukas - Spouse's involvement - effects on net income and family income

Mika Sulkuva - Exploring agricultural data using self-organizing maps

Borje Dernulf - Farm profile - system for improving management and farm database

10.25 Break

10.45 *Paper session VII*

Use of FADN data with IT / Web tools

Szilard Keszthelyi - Web-tool for modelling farm subsides and income in CAP 2014-2020

Arto Latukka - Statistical testing of differences of means in EconomyDoctor internet service

Csaba Pesti - Open source solutions in Hungarian FADN: data collection and income modelling

Narve Brattenborg - Developing a common open source platform for internal/external FADN services

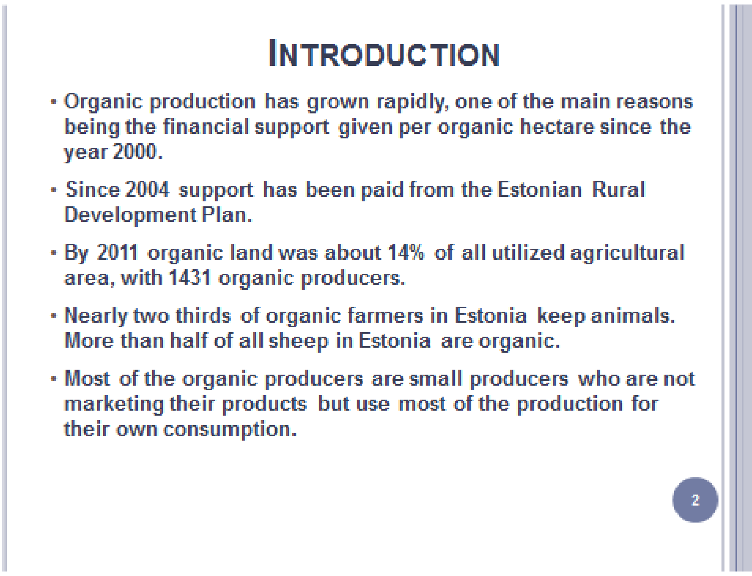
Antonella Bodini - IT tools and target users of the Italian RICA data

12.45 Lunch

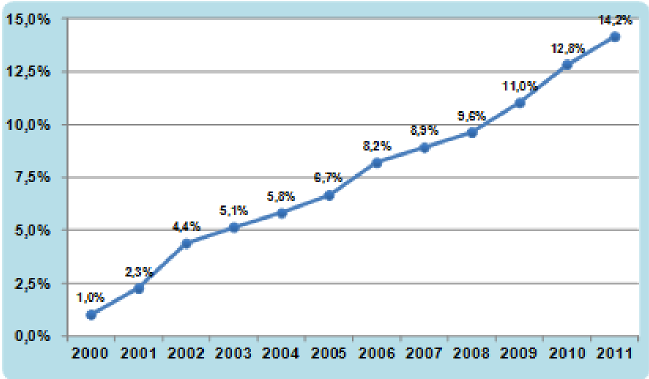
13.30 Departure

2 Economic performance and profitability of organic farms in Estonia

Eduard Matveev



Share of the organic area in the total UAA in Estonia, 2000-2011



Source: Statistics Estonia, Agricultural Board

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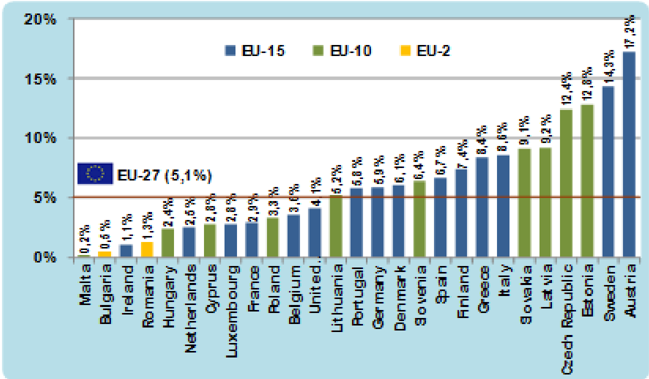
Share of the organic area in the total UAA, 2010



Source: Eurostat

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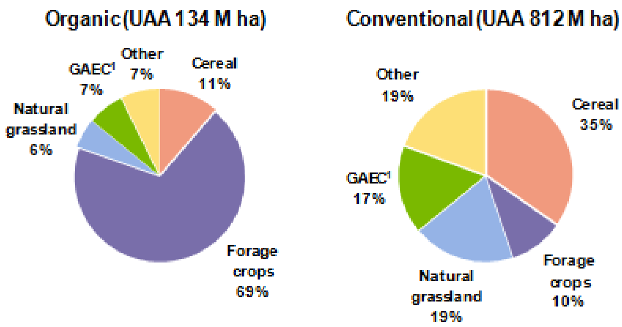
Structure of UAA in Estonia, 2011



[1] Land not used for agricultural production but maintained in good agricultural and environmental condition.

Source: Statistics Estonia, Agricultural Board

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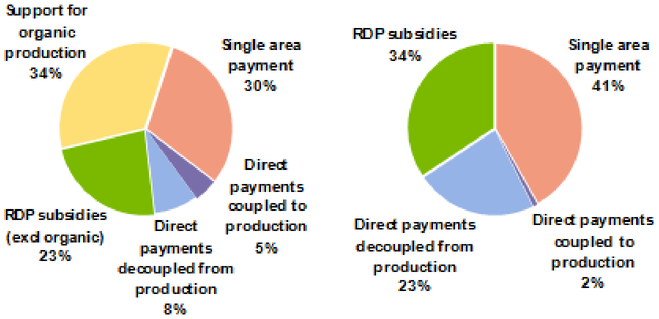
Structure of subsidies (excl on investments) in Estonia, 2010



RDP – Rural Development Plan
Source: Own calculation based on FADN data.

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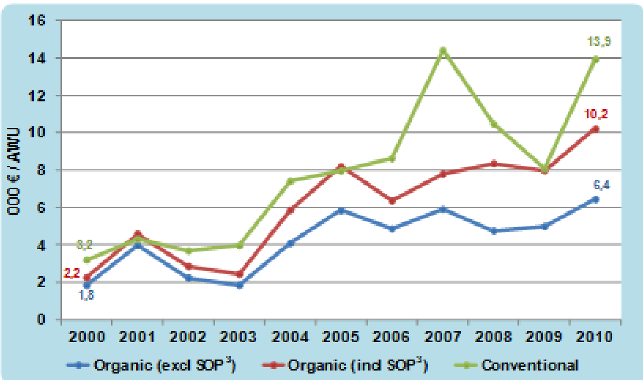
Farm income[1] per AWU[2] in Estonia



[1] Farm income refers to the Farm Net Value Added, i.e. to total output, plus direct payments minus intermediate consumption and depreciation.
[2] AWU – Annual Work Unit, i.e. 2200 working hours used as one AWU.
[3] SOP – Support for organic production.
Source: Own calculation based on FADN data.

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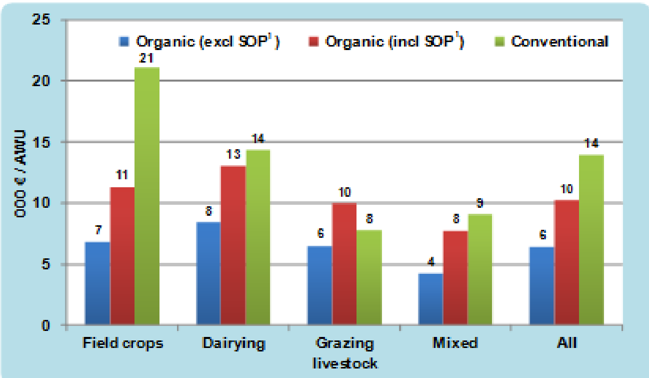
Farm income per AWU by farm type in Estonia, 2010



[1] SOP – Support for organic production.
Source: Own calculation based on FADN data.

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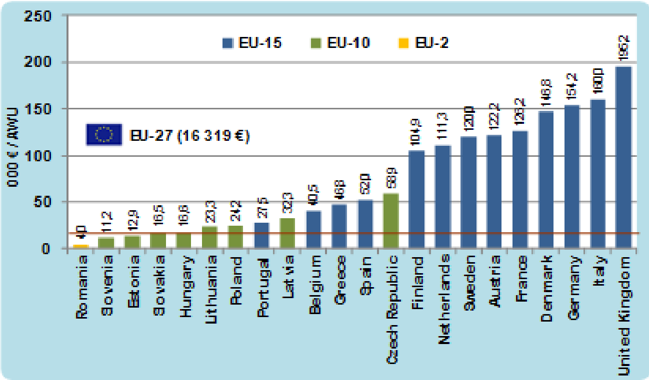
FARM INCOME PER AWU IN 2009[1]



[1] Only organic production methods.
SOURCE: EU FADN – DG AGRI.

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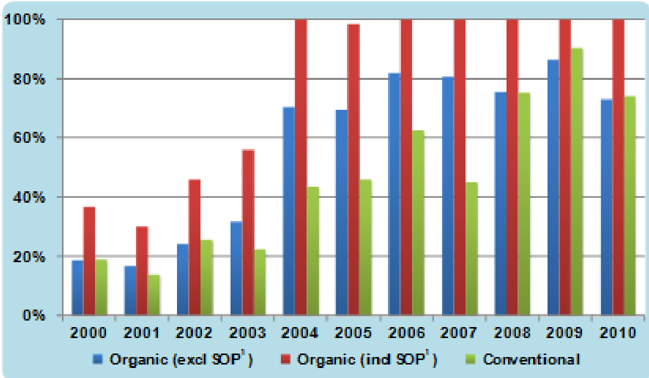
SHARE OF SUBSIDIES IN FARM INCOME IN ESTONIA



[1] SOP – Support for organic production.
SOURCE: OWN CALCULATION BASED ON FADN DATA.

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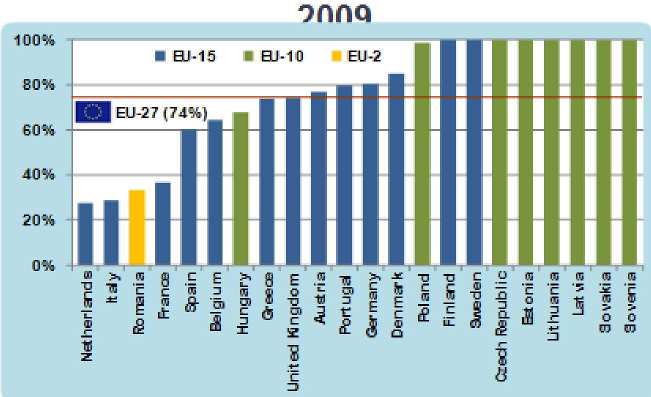
SHARE OF SUBSIDIES IN FARM INCOME IN 2009[1]



[1] Only organic production methods.
SOURCE: EU FADN – DG AGRI.

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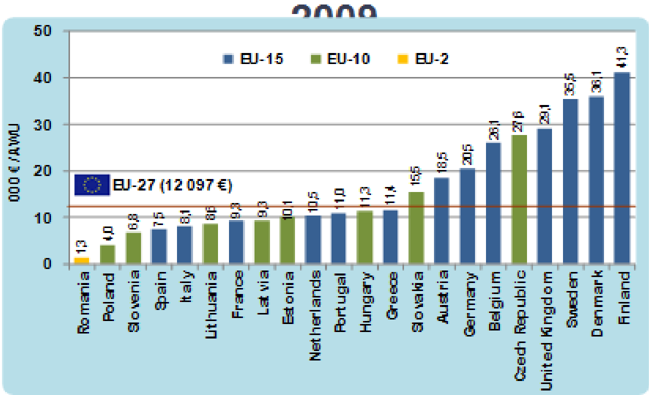
AVERAGE PAYMENTS PER AWU IN 2009 [1]



[1] Only organic production methods.
SOURCE: EU FADN – DG AGRI.

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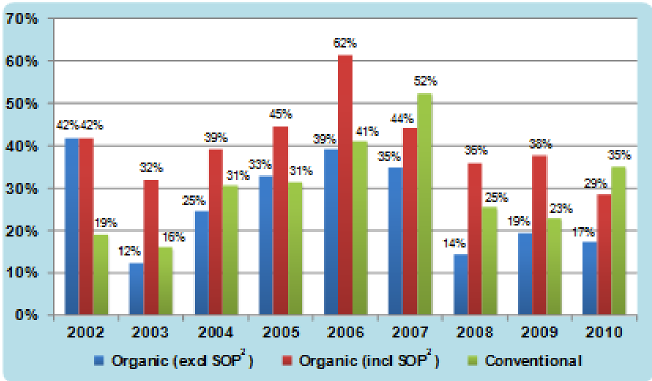
SHARE OF SUSTAINABLE[1] FARMS IN



[1] Sustainable farms defined on the bases of the Farm Net Value Added (NVA) produced on the farm per Annual Work Unit, i.e. in order to be sustainable, an farm should produce NVA at least 80% of average labour cost per year in manufacturing sector.
[2] SOP – Support for organic production.
SOURCE: OWN CALCULATION BASED ON FADN DATA.

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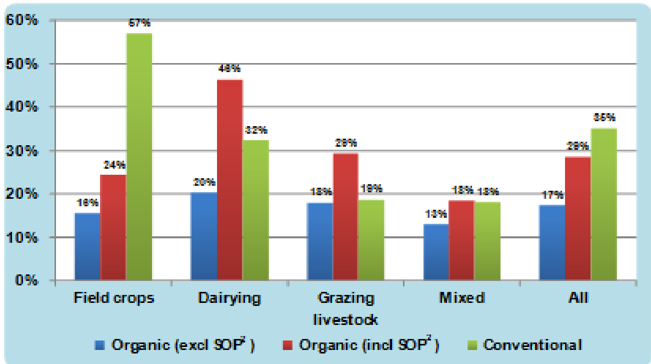
SHARE OF SUSTAINABLE[1] FARMS BY FARM TYPE IN ESTONIA, 2010



[1] Sustainable farms defined on the bases of the Farm Net Value Added (NVA) produced on the farm per Annual Work Unit, i.e. in order to be sustainable, an farm should produce NVA at least 80% of average labour cost per year in manufacturing sector.
[2] SOP – Support for organic production.
SOURCE: OWN CALCULATION BASED ON FADN DATA.

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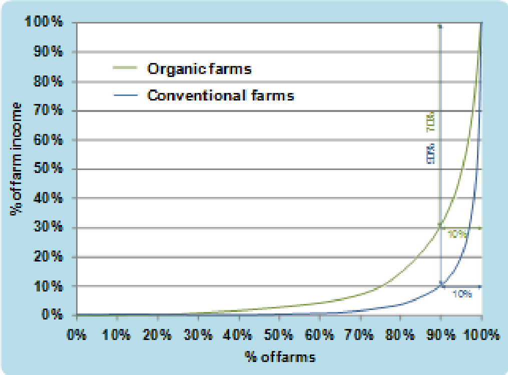
LORENZ CURVE FOR FARM INCOME[1] IN



[1] Farm income refers to the Farm Net Value Added, i.e. to total output, plus direct payments minus intermediate consumption and depreciation.

SOURCE: OWN CALCULATION BASED ON FADN DATA.

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CONCLUSIONS

- Organic farms receive on average higher subsidies per hectare than conventional farms. This is due to special support paid for organic production.
- Organic farms have on average a significantly lower income per AWU in comparison with conventional farms.
- The support for organic production are very important for the economic viability of Estonian organic farms.
- The share of subsidies in farm income is march higher for organic farms than for conventional farms.
- The sustainability of the organic farms depends greatly on the support for organic production.
- The analysis of farms by type of farming shows that only organic farms of grazing livestock type of farming produced more farm income than conventional farms.

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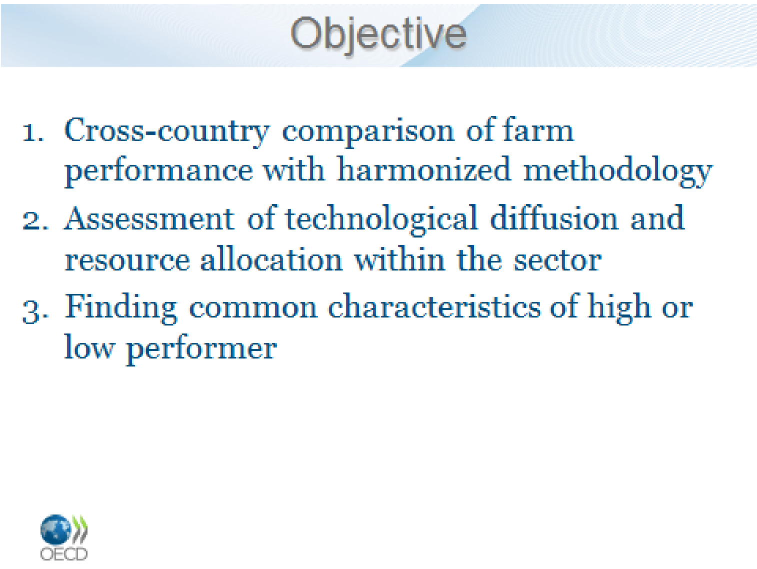
3 Cross country comparison of farm performance

Shingo Kimura



Outline

1. Description of data and methodology
2. Cross-country comparison of farm performance distribution by sector
3. Characteristics high/low performer
4. Cross-country factor analysis of high high performance
5. Conclusion

Data sources from 9 countries

- Germany, the Netherlands, Belgium (Flanders), Italy and Estonia : National FADN
- UK (England) : Farm Business Survey
- Australia : Broadacre and dairy farm survey
- USA : Agricultural Resource Management Survey
- Canada : Farm Financial Survey

 - Years are 2004, 2006, 2007, 2008 and 2009
 - The data generally covers 90% of production value

Four Farm Performance Indicators

(1) Output-Input Ratio
Gross agricultural output – cash expense ratio
(2) Return to Labor
Gross margin per full-time farmer equivalent labour input
(3) Return to Land
Gross margin per ha of utilized area of land
(4) Return on equity
Gross margin per net worth

Output does not include payments

Sector coverage

Quartile information by each indicator is reported by the following sector

- All farms
- Field crop
- Fruits and vegetable
- Dairy
- Beef and sheep
- Non-ruminant
- Mixed farm
- Nursery/Greenhouses (only The Netherlands)

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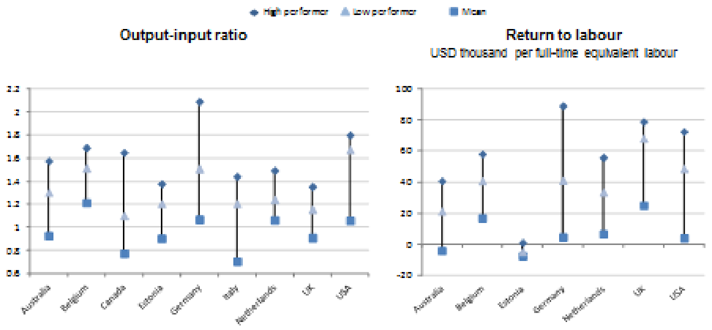
Cross country comparison: All farms



- ➢ US farm on average generates more output value per input compared to other countries
- ➢ UK farm obtains the highest return to annual labour input on average
- ➢ Top 25 percentile German farm achieves the highest performance

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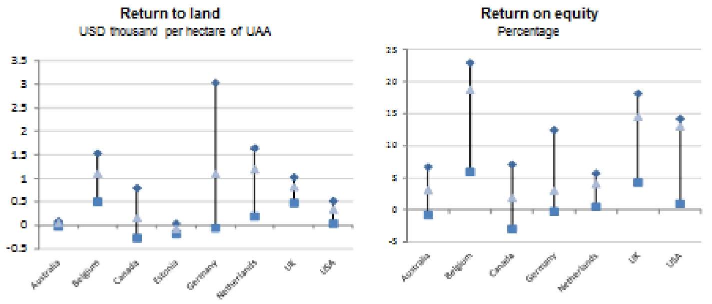
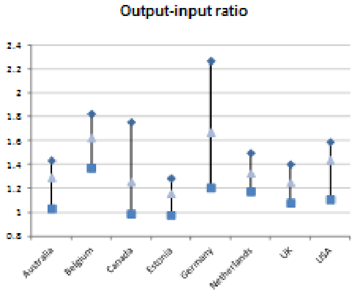
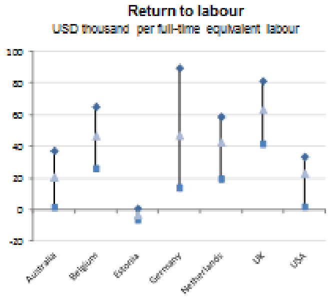
Cross country comparison: Field crop farm



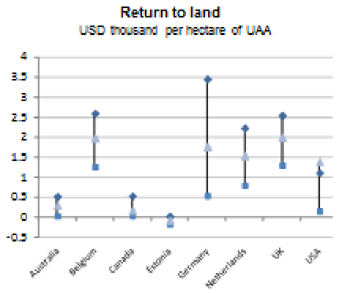
OECD

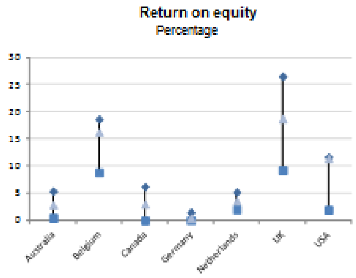
Cross country comparison: Dairy farm





Cross country comparison: Dairy farm





Distribution of farm performance

- **Standardized methodology allows cross-country comparison of different farm performance indicators**
  - Benchmarking of country's sector performance across countries and within country
- **Distributional information of farm performance has an implication for further policy analysis**
  - Distribution shows structural characteristics of the sector, degree of technological diffusion, which average information misses
  - Comparing distribution of performance across different indicators implies resource allocation issue

Characteristics of high/low performer

Farm characteristics

1. Farm size (Economic, Labour and Land)
2. Support
3. Off-farm activity
4. Operator's characteristics
5. Technological adoption and Investment

Cash input – output ratio is chosen as an indicator to define high/low performance group

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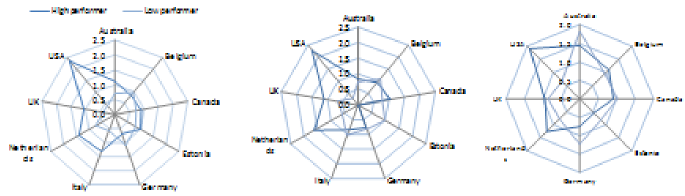
Farm size and farm performance

Economic farm size - Value of production

All farms
Relative to sector mean

Field crop farms
Relative to sector mean

Dairy farms
Relative to sector mean



- High performer tends to be large in US, UK and the Netherlands

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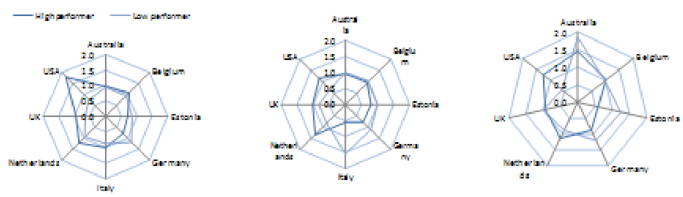
Farm size and farm performance

Labour size – Annual full-time equivalent labour

All farms
Relative to sector mean

Field crop farms
Relative to sector mean

Dairy farms
Relative to sector mean



- High performer tends to be large in US, UK and the Netherlands
- In dairy sector, low perfomer tends to have higher labour input

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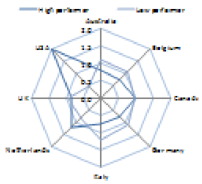
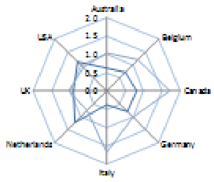
Support and farm performance

Amount of support received

All farms
Relative to sector mean



Field crop farms
Relative to sector mean



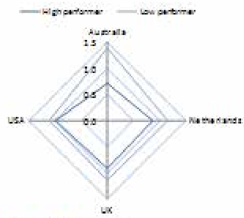
Dairy farms
Relative to sector mean

- Low performer tends to receive more support

Off-farm activity and farm performance

Off-farm income received

All farms
Relative to sector mean

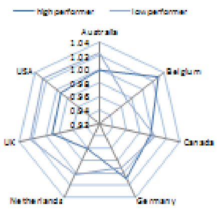


- Low performer has higher off-farm income

Operator's characteristics and farm performance

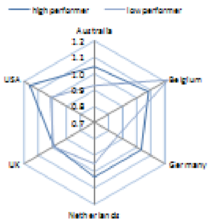
Main Operator's age

All farms
Relative to sector mean



Main Operator's education

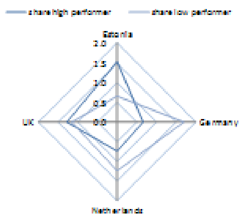
All farms
Relative to sector mean



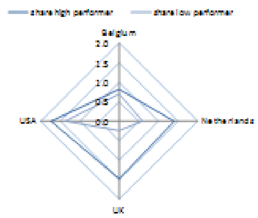
- Low performer tends to be old except for Germany and Belgium
- High performer has higher educational attainment except for Belgium

Technological adoption and farm performance

Organic technology adopted



Amount of net investment



- High performer tends to have higher net investment

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Cross-country factor analysis of high performance

Factor analysis is a statistical method to find a set of uncorrelated factors in a large dataset

Characteristics of high performers is normalized with respect to mean of the sector

Factor analysis is applied to find which factors are consistently explaining high performance across countries, across performance indicators and across years for a specific sector

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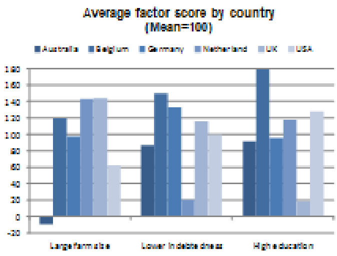
Factors of high performance: Field crop farms

Factor loadings after rotation

	Factor 1	Factor 2	Factor 3	Uniqueness
Variance	3.25	1.30	0.82	
Proportion in total variance	0.58	0.23	0.15	
Factor loadings				
Gross agricultural output	0.88	-0.07	0.08	0.21
Annual labor input	0.73	-0.37	-0.06	0.33
Utilized area of land	0.82	0.12	-0.06	0.30
Net worth	-0.03	0.74	0.13	0.43
Net investment	-0.10	-0.20	-0.51	0.70
Total support	0.92	0.12	0.09	0.14
Age of the main operator	-0.47	0.27	-0.08	0.70
Education of the main operator	0.35	0.36	0.52	0.47
Share of less favored land	-0.26	-0.30	0.47	0.62
Adoption of organic technology	-0.01	-0.49	0.16	0.74
Factor characteristics				
Factor 1	Large farm size			
Factor 2	Lower indebtedness			
Factor 3	High education			



- Farm size factor account for 58% of the total variance and it is the least relevant in Australia, followed by USA
- Education factor is important in Belgium. UK has the lowest score, meaning that high education factor is not relevant factor of high performance

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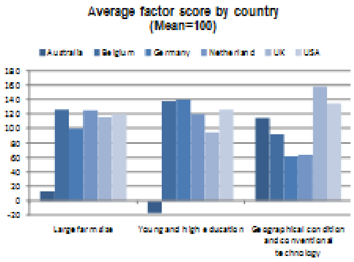
Factors of high performance: Dairy farms

Factor loadings after rotation

	Factor 1	Factor 2	Factor 3	Uniqueness
Variance	3.30	1.10	0.86	
Proportion in total variance	0.62	0.21	0.16	
Factor loadings				
Gross agricultural output	0.75	0.20	0.28	0.31
Annual labor input	0.79	0.08	-0.03	0.37
Utilized area of land	0.86	0.16	0.12	0.23
Net worth	0.59	-0.24	-0.04	0.59
Net investment	0.46	0.03	0.40	0.62
Total support	0.77	0.49	0.19	0.13
Age of the main operator	-0.29	-0.71	0.04	0.41
Education of the main operator	0.25	0.45	0.17	0.70
Share of less favored land	-0.19	-0.11	-0.51	0.70
Adoption of organic technology	-0.18	0.04	-0.53	0.69
Factor characteristics				
Factor 1	Large farm size			
Factor 2	Young and high education			
Factor 3	Geographical condition and conventional tech			



- Farm size factor account for 62% of the total variance and it is the least relevant in Australia, whereas it is more important for Belgium, Netherlands, UK and USA.
- Age and education factor is the least important in Australia, while is more important in Belgium and Germany.

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Limitations of the methodology

- Four indicators are all partial productivity indicators, which does not allow the multi-factors productivity comparison
- There are a number of uncontrolled factors (e.g., geographical condition)
- Although countries are following the common methodology, definition of the sector, variables and survey target may be different.

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4 Analysis of Productivity Change in German Dairy Farms

Werner Kleinhanss

4.1 Introduction

The development and change of productivity, as well as its influencing factors, is of interest in economic research. Analysis is usually done at the global or sector level. An assessment of productivity changes at the micro level is one of the activities of the OECD working group on 'Farm Level Analyses'. While searching for different measurement concepts and programming tools, we gained access to a software package provided by CEPA. The programme allows the calculation of well known Total Factor Productivity (TFP) indexes, i.e., Laspeyres, Paasche, Fischer, Lowe, Malmquist, Hicks-Moorsteen, and the Färe-Primont Index. However, the free-of charge version used is limited to the calculation of the last mentioned tree indexes. In this study we use this programme for productivity analysis for a balanced sample of dairy farms in the North of Germany. Method and data is briefly described, and then results on productivity changes are explained and compared with income indicators.

4.2 Method and data

The developer of the software package DPIN, O'DONNELL (2011), argues that the 'Laspeyres, Paasche, Fisher, Malmquist-hs, Malmquist-it and Hicks-Moorsteen indexes all fail the transitivity test and can generally only be used to make a single binary comparison (i.e., to compare two observations). Only the Lowe and Färe-Primont indexes are economically-ideal in the sense that they satisfy all economically-relevant axioms and tests from index number theory, including an identity axiom and a transitivity test. This means they can be used to make reliable multi-temporal (i.e., many period) and/or multi-lateral (i.e., many firm) comparisons of TFP and efficiency'. A further advantage of the Lowe and Färe-Primont Index is that prices for input and output are not required, and shadow prices derived from the Linear Programming solution are used instead. Especially input prices are often lacking at the farm level. As the Lowe index can only be calculated with the professional version, we focus on the Färe-Primont index, which can be calculated with the free-of charge version of DPIN. Although shadow prices cannot be listed by the free-of-charge version, they are internally calculated.

The Färe-Primont defined by O'DONNELL (2011) is composed of two indexes developed by FÄRE and PRIMONT (1995, p. 36, 38):

$$TFP_{hs,it} = \frac{D_O(x_0, q_{it}, t_0)}{D_O(x_0, q_{hs}, t_0)} \frac{D_I(x_{hs}, q_0, t_0)}{D_I(x_{it}, q_0, t_0)}$$

'The Färe-Primont TFP index is quite general in the sense that it doesn't require any restrictions on the production technology apart from those that might be necessary for the distance functions to be well-defined' (O'DONNELL, 2011). The calculation of this index is calculated in following steps:

- Calculation of output and input distance functions in solving LP's

$$(55) \qquad D_O(x_0,q_0,t_0)^{-1} = \min_{\alpha,\gamma,\beta}\{\gamma + x_0'\beta : \gamma\iota + X'\beta \geq Q'\alpha; q_0'\alpha = 1; \alpha \geq 0; \beta \geq 0\}$$

$$(56) \qquad D_I(x_0,q_0,t_0)^{-1} = \max_{\phi,\delta,\eta}\{q_0'\phi - \delta : Q'\phi \leq \delta\iota + X'\eta; x_0'\eta = 1; \phi \geq 0; \eta \geq 0\}$$

- Calculation of aggregate output and inputs

$$(61) \qquad Q_{it} = (q_{it}'\alpha_0)/(\gamma_0 + x_0'\beta_0)$$

$$(62) \qquad X_{it} = (x_{it}'\eta_0)/(q_0'\phi_0 - \delta_0)$$

- Calculation of shadow prices

$$(88) \qquad p_0^* = \partial D_O(x_0,q_0,t_0)/\partial q_0 = \alpha/(\gamma + x_0'\beta)$$

$$(89) \qquad w_0^* = \partial D_I(x_0,q_0,t_0)/\partial x_0 = \eta/(q_0'\phi - \delta).$$

Limitations of this index are:

- It is calculated referring to a reference farm (to be determined) in the base period. In the following we alternatively recalculate the indexes for the remaining farms.
- The model only solves with rescaled data, which might influence the results. An alternative solution would be to exclude outlying observations. As we already dropped outlying observations, we didn't go forward in this direction.
- Shadow prices are handled as 'black box'. Results might be biased by zero values. This aspect could only be proved with the professional version of DPIN.
- The number of observations is limited to 5000, which might be not enough in running the model for all dairy farms in Germany.
- Weighting of observation, which is usual in using representative farms of FADN, is not possible in the model.

After first tests with a sample of 40 farms we selected a balanced sample of 170 dairy farms for 15 periods (1996/97 - 2010/11) from the national FADN. Farms are located in the North of Germany (Lower Saxony and Schleswig Holstein). Only farms with more than 30 dairy cows in 2009/10 and with milk production in each period are included. Furthermore, a few observations with outlying data are excluded. For the model we used a rather aggregated set of variables;

- 3 outputs: milk (€), other returns (€), subsidies (€)
- 5 inputs: variable input of crop production (€), livestock (€), other costs (€, excl. land rentals and hired labour costs); UAA (ha), AWU

For further differentiation of results we use tree size classes (dairy cows): 1: 30-60; 2: 60-100; 3: >100 and we included income indicators for the comparison of productivity development. Box plots are processed to summarize and to show the variation of results.

4.3 Results

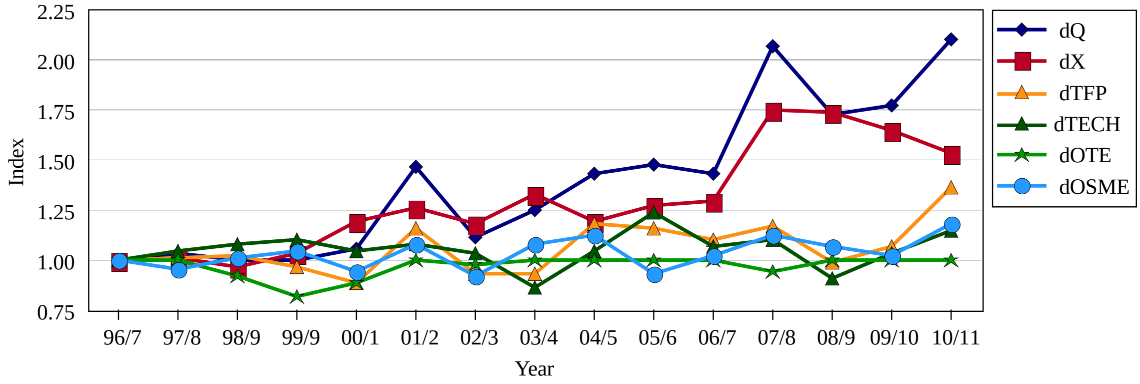
In this chapter we show first results for one farm taken as example. Then we describe changes of productivity for groups of individual farms as well as the variation by farm size. Lastly, we compare these results with the development of income usually taken as main indicator for economic performance.

4.3.1 Development of productivity referring to a reference farm

The underlying farm (ID=10) has been taken as reference in the calculation of Färe-Primont index. Figure 1 shows the development (change) of productivity (dTFP) over the 15 year period, taking 1996/97 as reference. It is rather constant in the first three years, then moves down to 0.89 in 2000/01, which might be an effect of the BSE crisis. It moved up to around 1.17 in 2001/02 and 2004/05 to 2007/08. Periods with negative productivity change (<1) were in 2002/03 and the following year, as well in 2008/09. The highest level was reached in 2010/11. Therefore productivity increased by 0.37 during this 15-year period. Change of this index is the result of change of aggregated output referring to aggregated input. A high level of aggregated output is a sign for rather high milk prices.

Beside these indicators the model also calculates other economic measures, of which only changes of technical efficiency (dTech), changes of output-oriented technical efficiency (dOTE) and change of output-oriented scale mix efficiency (dOSME) are shown. dOTE is restricted to 1; it is less than 1 in the first periods indicating a low output-oriented efficiency change. Development of dOTE and dOSME are related to dTFP, but with time lags and reaching lower levels in 2010/11.

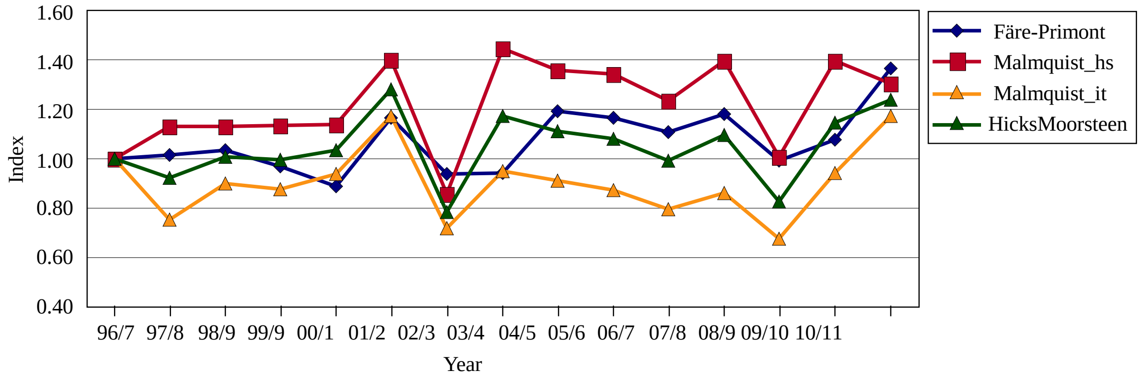
Figure 1 Level and decomposition of Färe-Primont Index (Farm 10)



Source: Own calculations based on BMELV-Testbetriebe (Kleinhanß, 2012)

To get insights in the variation of different TFP indices we also calculate Hicks-Moorsteen and Malmquist-hs (it) indices (Figure 2). All indexes show a strong decrease in 2002/03 and 2008/09. Development and level of the Hicks-Moorsteen index is similar to Färe-Primont, while the Malmquist index differs between the firm specific (-hs) and the period specific (-it). The selection of an appropriate index is therefore a challenge.

Figure 2 Development of different TFP indexes

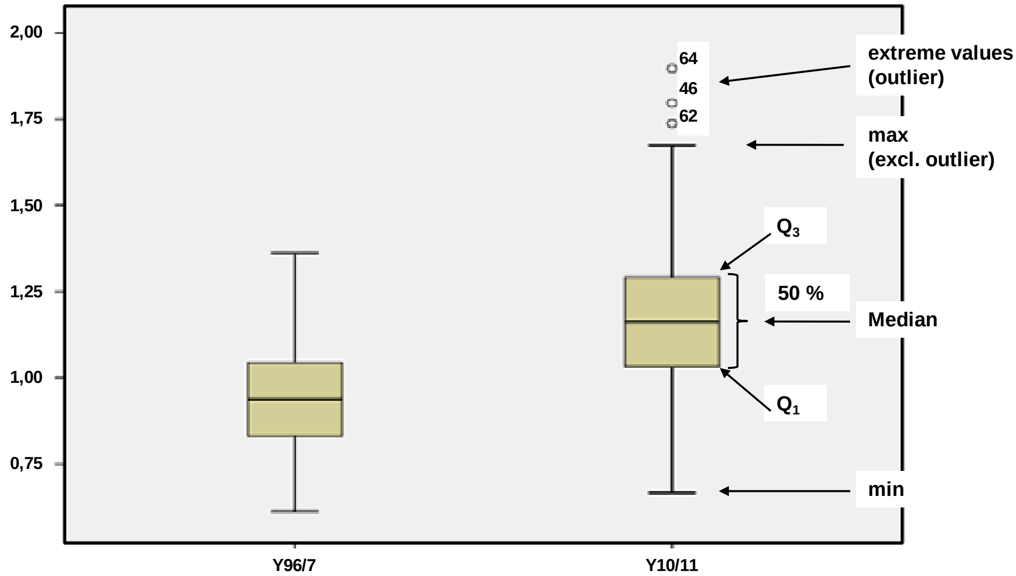


Source: Own calculations based on BMELV-Testbetriebe (Kleinhanß, 2012)

4.3.2 Variation of TFP

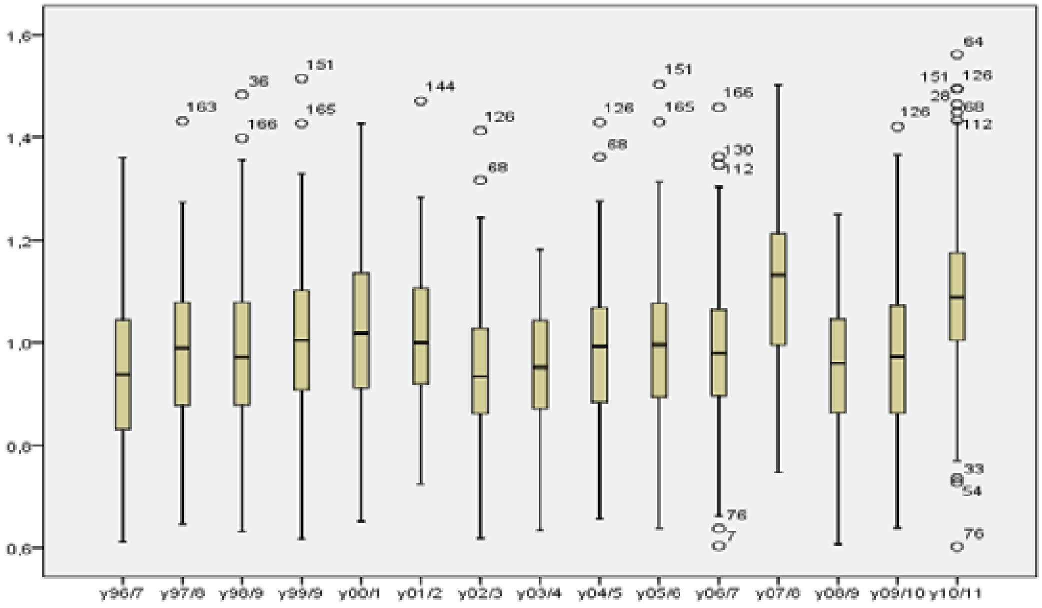
At first we discuss non-standardized Färe-Primont indexes. The box plot in Figure 3 shows the level (Median) and variation (50 % of farms between 1st and 3rd Quantile, as well as minimum and maximum TFP's and so-called outliers (o) and extreme values (*)). In 1996/7 the Median is less than 1 (referring to the reference farm, 50 % of farms shows TFP's between 0.85 and 1.1; TFP varies between 0.6 and 1.4. In 2010/11 it increased to about 1.15 (Median). 50 % of farms show TFP form 1.05 to 1.3 and the spread between min and max becomes larger; furthermore a few outliers are indicated. This shows a positive development of TFP.

Figure 3 Level and variation of Färe-Primont index in 1996/97 and 2010/11



Development of TFP over the whole period is shown in Figure 4. TFP successively increased until 2000/01, followed by a period of lower productivity until 2006/07. Highest TFP was reached in 2007/08 due to favourable price levels especially for milk. In 2008/09 - due to lower prices - TFP was even lower than in the first period. TFP moved up in 2010/11 to almost the same level as in 2007/08.

Figure 4 Development and variation of Färe-Primont index

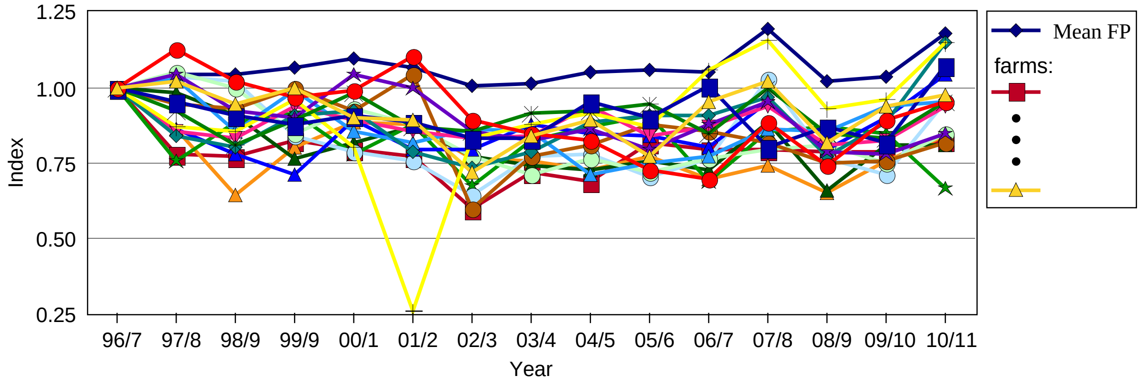


4.3.3 Variation of standardized TFP

As mentioned above, the Färe-Primont is expressed for all periods and farms referring to the first period of the reference farm (ID=10); in Annex Table A, an example for farm (10) and (71) is given. With regard to the reference farm, productivity of farm 71 is only 0.81 in the first and 0.97 in the last period. For the comparison of farms we standardize TFP's =1 in period 1. Therefore the TFP of Farm 71 moves to 1 in period 1 and to 1.21 in period 15. The change of productivity over the whole period is therefore lower than of the reference farm.

Figure 5 shows the development of standardised Färe-Primont index for the 10 % of farms with lowest TFP (mean over all years) - in comparison to average TFP. Average change of TFP is less than those of the reference farm; it is rather low until 2006/07, rising to 1.2 in 2007/08 and 2010/11 under conditions of high milk prices. Most farms included show less than average TFP indices and some less than 1, indicating a negative development of productivity.

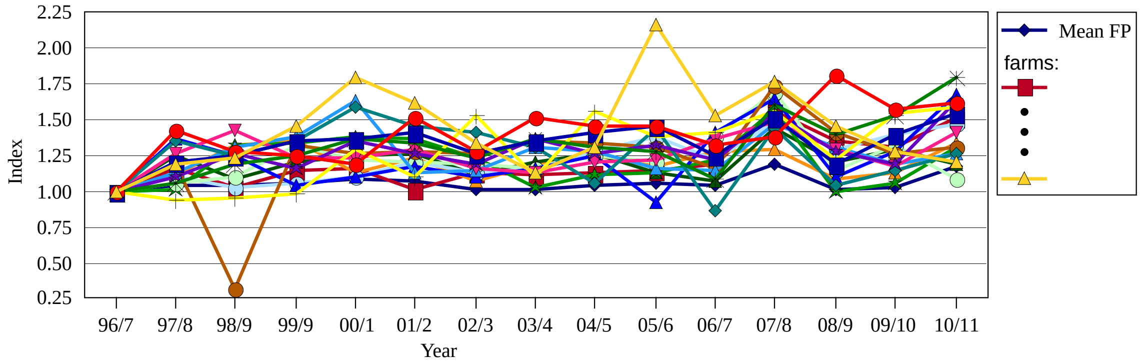
Figure 5 Development of standardised TFP of 10 % of farms with lowest average TFP (over all years)



Source: Own calculations based on BMELV-Testbetriebe (Kleinhanß, 2012)

The situation is much better in the 10 % of farms with highest TFP (Figure 6). TFP increase to about 1.2 until 1999/2000 and stay at this level until 2006/07. It significantly increased in 2007/08. Beside this trend there is a significant variation between farms with some extreme values on a positive and negative direction.

Figure 6 Development of standardised TFP of 10 % of farms with highest average TFP (over all years)



Source: Own calculations based on BMELV-Testbetriebe (Kleinhanß, 2012)

The development and variation of standardized TFP between all sample farms is shown in Figure 7. Due to standardization TFP becomes 1 in the first period. The general trend of TFP is similar to Figure 4 but with a slightly higher level. TFP was highest in 2007/08; nevertheless there were farms with TFP less than 1.

Figure 7 Development and variation of standardised TFP (index)

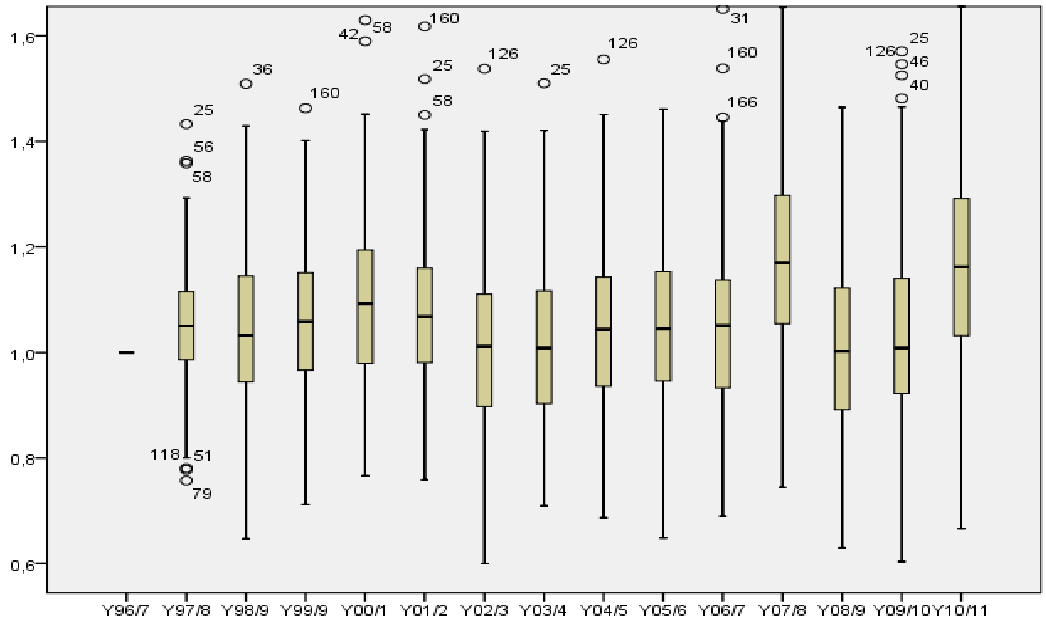
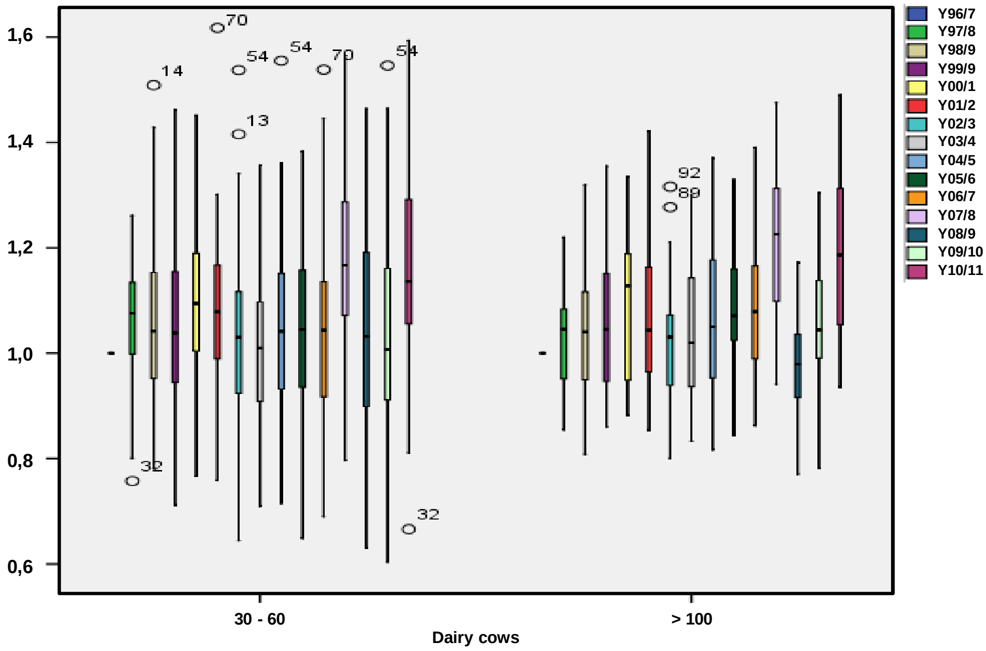


Figure 8 shows the development and variation between small (30-60 dairy cows) and large (>100) farms. The picture looks similar in most years but with a slightly higher level of the large farms. However, there are a few differences:

- The variation of TFP between min and max is higher in small farms

- TFP of large farms is more sensitive wrt price changes; in the year of crisis (2008/09) the TFP level on average was considerably lower than in small farms.

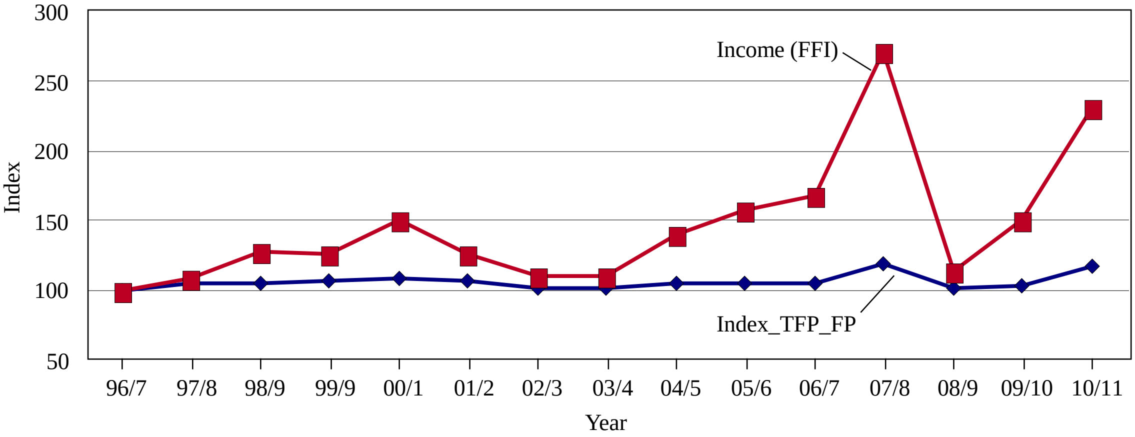
Figure 8 Development and variation of TFP (index) for medium (30-60) and large sized farms (>100 dairy cows)



4.3.4 Comparison with income

In the following we compare development of TFP with income. We use Family Farm Income (FFI) expressed in € per farm as income indicator. Figure 9 compares the development of TFP and FFI relative to the base year (= 100). As already mentioned, changes of TFP are rather low; in most of the years it is close to 1 and only in 2007/08 and 2010/11 does it move up to around 120. The development of FFI is more significant; it increases to 150 in 2000/01, and then goes down to near 100 in 2003/04 and the succeeding year. In 2007/08 it switches to its highest level of 270. In the year of crisis (2008/09) it drops again to close to 100. It recovers to 230 in 2010/11. This indicates that the variation of income is much higher than the development of TFP.

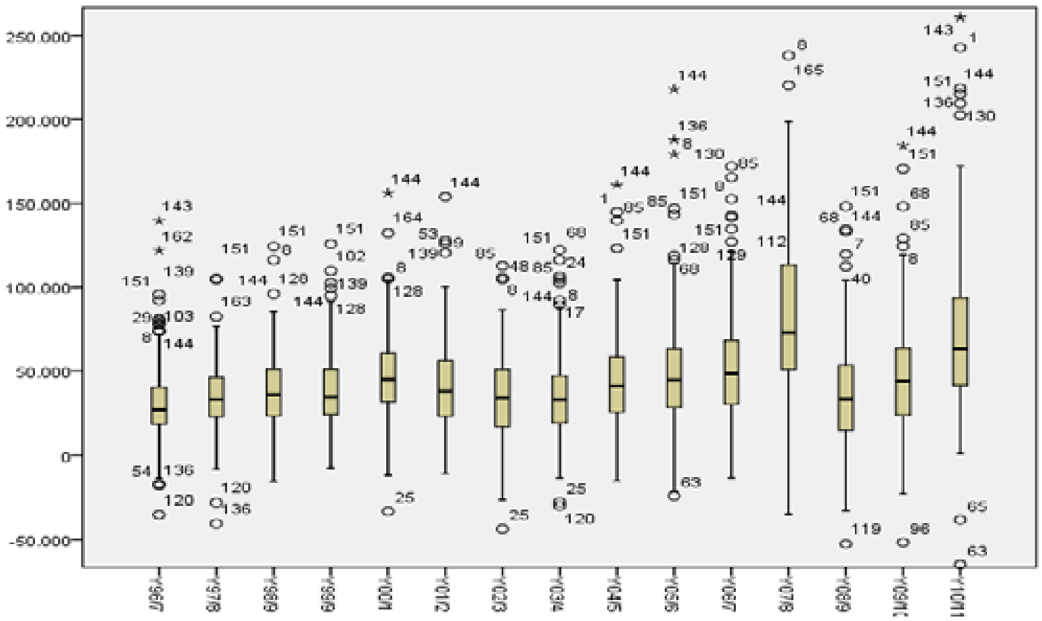
Figure 9 **Development of average TFP and income referring to 1996/97 (= 100)**



Source: Own calculations based on BMELV-Testbetriebe (Kleinhanß, 2012)

Absolute levels of FFI and its variation for all farms are given in Figure 10. Income in 50 % of farms (between Q3 and Q1) was less than 50 k€ in the first 4 years. A first high was reached in 2000/01, and it then fell again in the following 3 years. It reached 2000/01 levels in the years 2004/5 to 2006/7. The highest level was reached in 2007/8 with 50 k to about 100 k€.

Figure 10 **Development and variation of Family Farm Income (€/farm**



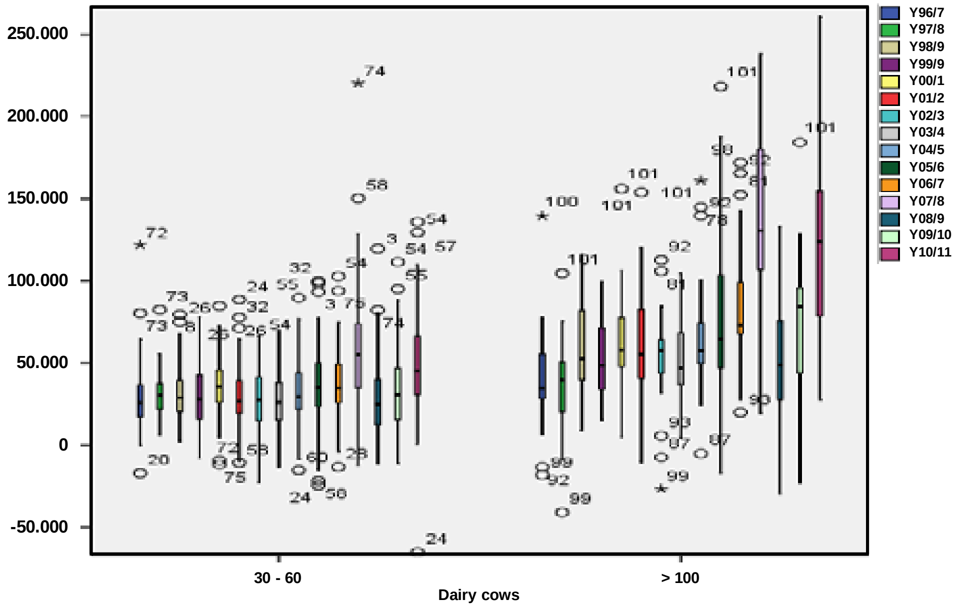
Farm size has a significant impact on the income level; Figure 11 compares FFI for small and large farms. In the group of small farms (30-60 dairy cows) FFI in 50 % of farms (between Q1 and Q3) was less than 50 k€ in all years; only in 2007/08 and 2010/11 did it increase significantly. For the large farms (>100 dairy cows) a significant share reached income levels >50 k€ in ten years. Income almost doubled in 2007/08 or increased by two-thirds in 2010/11. However, the overall variation of income is larger than in small farms.

It is also of interest to look at the so-called outliers (o) or extreme values (*):

- Farm 99 had negative incomes in 3 years
- On the other hand, Farm 101 reached its highest income levels in 6 years.

It would be of interest to analyse causes for high income levels, but this is out of the scope of this paper.

Figure 11 Development and variation of Family Farm Income in small (30-60) and large farms (>100 dairy cows) (€/farm)



4.4 Conclusions

The changes of TFP (Färe-Primont) are rather low. In about half of the years TFP it is close to 1, while it increased significantly in years of favourable milk prices (2007/08 and 2010/11). The rather low changes of TFP can be explained by the milk quota system which restricts farm growth. Another factor is the implementation of the milk market reform since 2003.

As is well known, that there is a significant spread of TFP (and income) between farms. Farms of the lowest decile show TFP levels less than 1, indicating negative TFP growth. Farms belonging to the upper decile show TFP levels greater than 1 up to a maximum of 1.5.

The development of income is more pronounced than TPF changes. Income was rather low but more stable until 2006/07. It became rather volatile in the succeeding years with the highest level in 2007/08, mainly determined by favourable milk prices.

4.5 References

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O'Donnell, C., 2012b. 'Nonparametric estimates of the components of productivity and profitability change in U.S. agriculture.' In: *Am JAgric Econ* 94, pp. 873-890.

5 Distribution of performance and factors associated with better efficiency

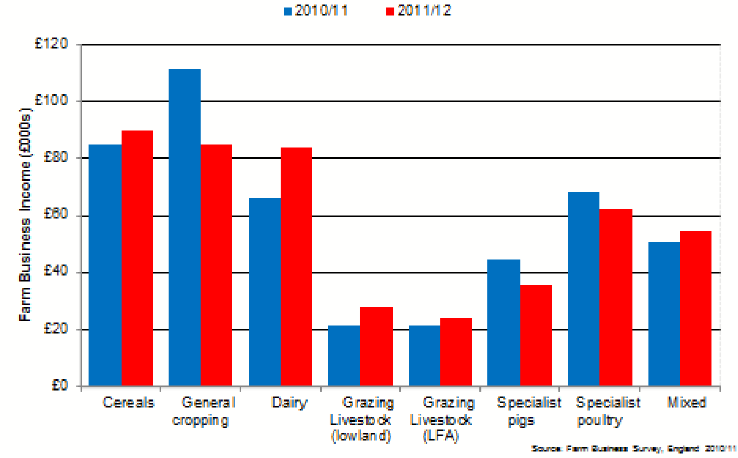
Andrew Woodend

20th Pacioli Workshop, Rome; Distribution of Farm Performance and Factors Associated with Better Efficiency, 1st October 2012

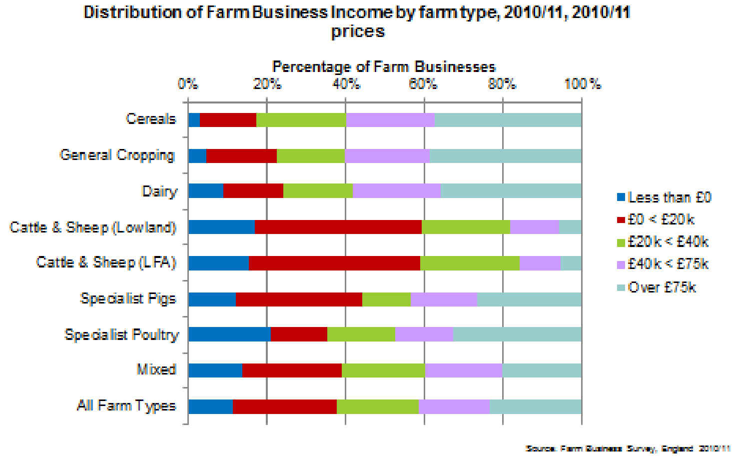
The Farm Business Survey (England)

- The Farm Business Survey (FBS) is an annual survey providing information on the financial position and physical and economic performance of farm businesses in England.
- Around1,900 farm businesses, covering all regions and all types of farming, with data collection on-farm, including interview with the farmer.
- Results are weighted so as to represent the whole population.
- Sample 'represents' around 60,000 farm businesses in the population. Very small farms are excluded - vast majority of the farms have enough cropping or stocking to occupy the farmer for at least half their time.

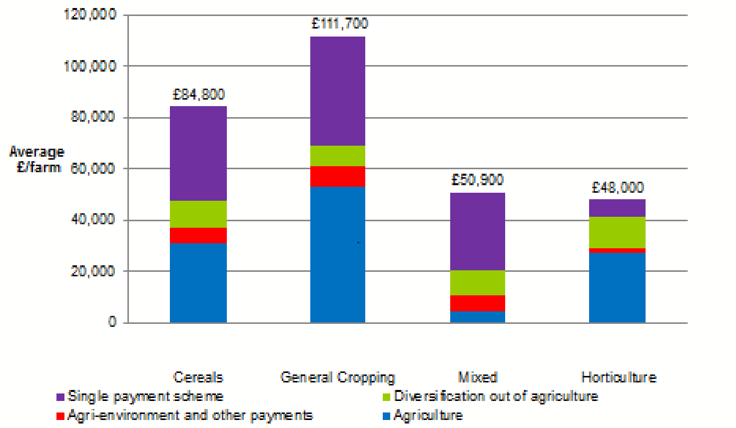
Average farm business income (£000s) by farm type, England 2010/11 and 2011/12



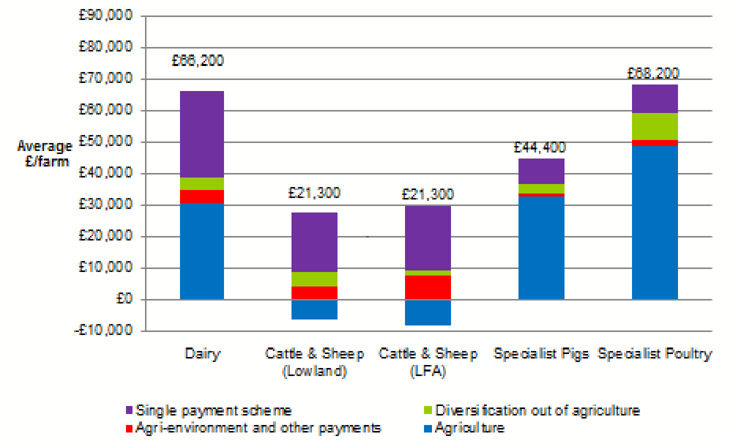
Distribution of Farm Business Incomes by farm type in England, 2010/11



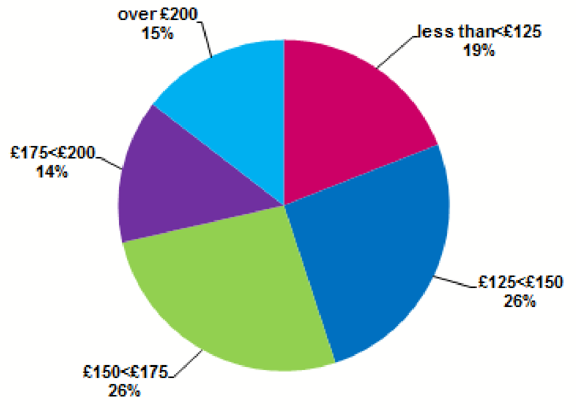
Breakdown of Farm Business Income by Cost Centre, cropping farms, 2010/11



Breakdown of Farm Business Income by Cost Centre, livestock farms, 2010/11

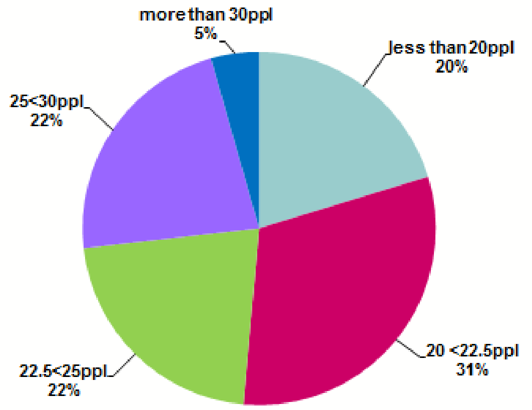


Proportion of wheat produced on basis of production costs (£/tonne) 2010/11



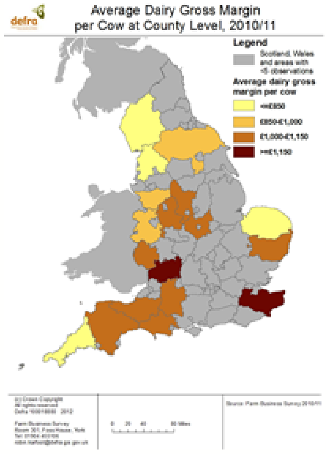
Source: Farm Business Survey, England 2010/11

Proportion of milk produced on basis of production costs (pence/litre) 2010/11



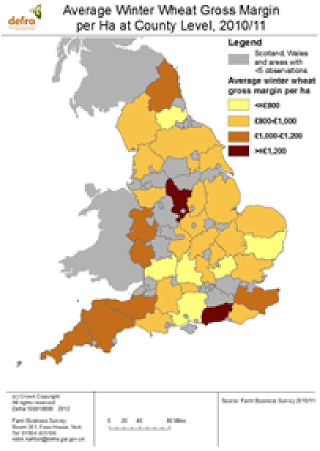
Source: Farm Business Survey, England 2010/11

Gross Margin Mapping: Dairy at county level



- Many counties have fewer than 5 observations so have been suppressed
- All county level gross margins within the range £788-£1,215 per cow
- Lowest is Cumbria, highest is Gloucestershire
- Relatively big differences between neighbouring counties (Norfolk/Suffolk, Devon/Cornwall)

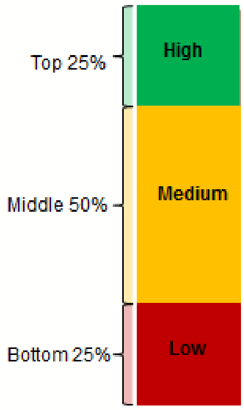
Gross Margin Mapping: Winter wheat at county level



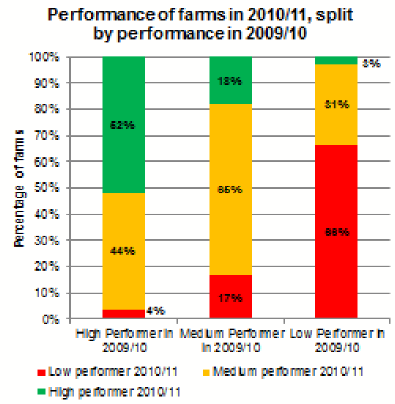
- Better coverage than for dairy
- All county level gross margins within the range £625-£1,310 per hectare
- Lowest is Gloucestershire, highest is West Sussex
- Gross Margins relatively low in cereal strongholds (East Anglia, Lincolnshire, East Yorkshire)
- Surviving farms in geographically disadvantaged areas may be better managed

Measuring economic performance

$$\frac{\text{Value of Output}}{\text{Cost of Inputs}}$$



Farm business performance: consistency over time



Note: based on performance within farm types, unweighted data, excludes unpaid labour

- Pattern as expected
- Over half of farms stayed in same band
- Very few moved from high to low or vice versa within one year
- Note: middle column represents 50% of farms
- More persistency in low performers than high performers

Farm business performance: consistency over time

Correlation between 2010/11 and 2009/10 performance percentiles, split by farm type

Farm Type	Correlation
Dairy	75%
Poultry	73%
Pigs	73%
Lowland Grazing Livestock	71%
LFA Grazing Livestock	67%
Mixed	66%
All types	**66%**
Horticulture	58%
Cereals	57%
General cropping	49%

Note: based on performance within farm types, unweighted data, excludes unpaid labour

- Strong positive correlation for all farm types, suggesting consistent performance in both years
- Most consistent for Dairy, least consistent for General cropping
- Correlation of 100% would represent no change between years

Drivers of Efficiency - Overview

a) What do we mean by good performance?

b) How does performance vary from farm to farm?

c) What do we think, based on the evidence so far, drives performance?

Variation in economic performance

Two studies have been completed by the Defra Observatory looking at the variation in economic performance between farms.

One looks specifically at cereal farms, the other looks at grazing livestock farms.

The published reports are available at:

- http://www.defra.gov.uk/statistics/files/defra-stats-foodfarm-environ-obs-research-arable-cereals-110505.pdf
- http://www.defra.gov.uk/statistics/files/defra-stats-foodfarm-environ-obs-research-cattle-grazingrep-120308.pdf

Grazing Livestock Farms: Study

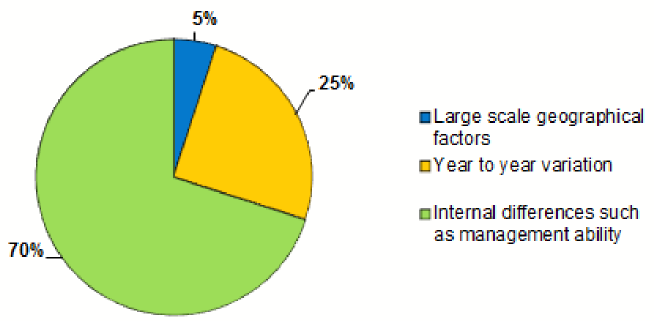
The grazing livestock study used FBS data for England over the period 2003 – 2009. 545 farms were included in the sample.

The study looked at the extent to which variation in economic performance could be explained by:

- Large scale geographic factors
- Year to year variation
- Internal differences such as management ability

Grazing Livestock Farms: Results

Study suggests that most variation between farms stems from between farm differences, such as differences in management ability.



Grazing Livestock Farms: Results

Factors that help to explain the variation in efficiency between livestock farms:

- •Debt (-)
- •Tenure and farm age
- •Land area (+)
- •Specialisation (+)
- •Diversification (+)
- •Farm assurance (+)
- •Unpaid family labour (+)
- •Contract work (+)
- •Livestock type
- •Organics
- •Size

Grazing Livestock Farms: Results

The grazing livestock study also found that some business management practices are linked to economic efficiency.

High performing businesses are more likely to:

- use management accounting practices, including benchmarking
- have a PC and use the internet for submitting forms electronically
- use business management exercises to plan ahead
- put in practice actions to bring about environmental improvements
- show a high level of interaction with customers
- adopt risk management strategies
- use technical advice obtained from events and demonstrations

Cereal Farms: Results

Factors that help to explain the variation in efficiency between cereal farms:

- •Debt (-)
- •Tenure (+)
- •Farmer age
- •Land area (+)
- •Specialisation (+)
- •Diversification (-) *(for agriculture)*
- •Farm assurance
- •Unpaid family labour (+)
- •Contract work (+)
- •Organics
- •Size (+)

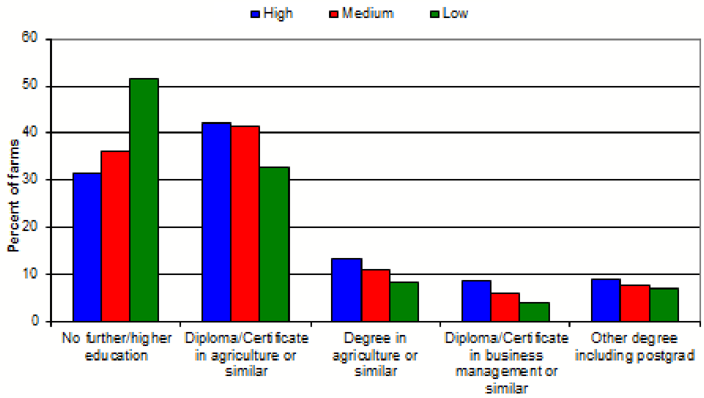
Business Management Practices Module

This section of the FBS was run for the first time in 2007/08.

Data was collected on business management practices from a sub sample of farm businesses. Completion of the management practices section was voluntary. Around 1,450 farm businesses completed returns.

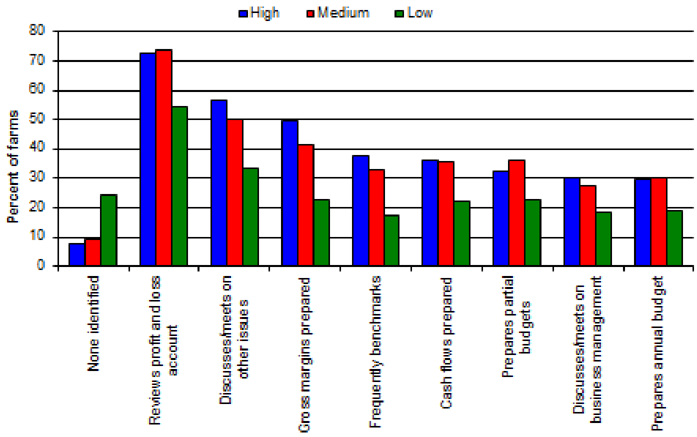
The information collected covered practices, techniques, skills and qualifications that farmers use to make business decisions.

Further/Higher Education by Economic Performance – 2007/08



Source: Farm Business Survey, England 2007/08

Application of Skills in Management Accounting by Economic Performance – 2007/08



Source: Farm Business Survey, England 2007/08

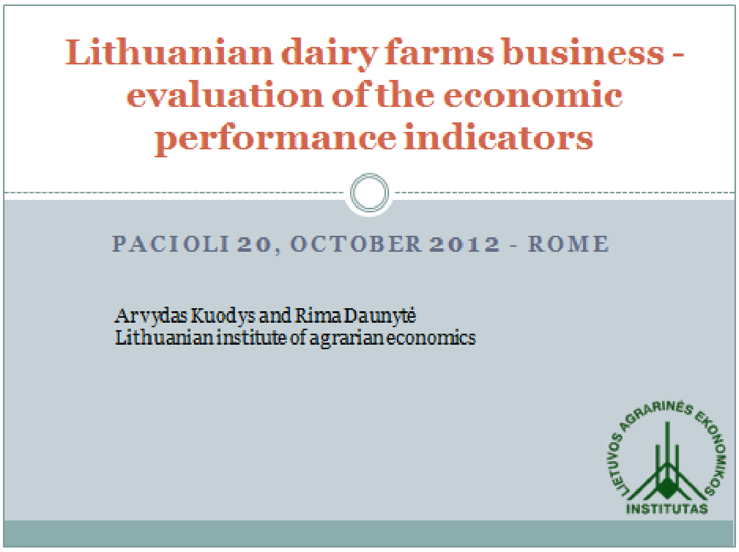
What drives economic performance?

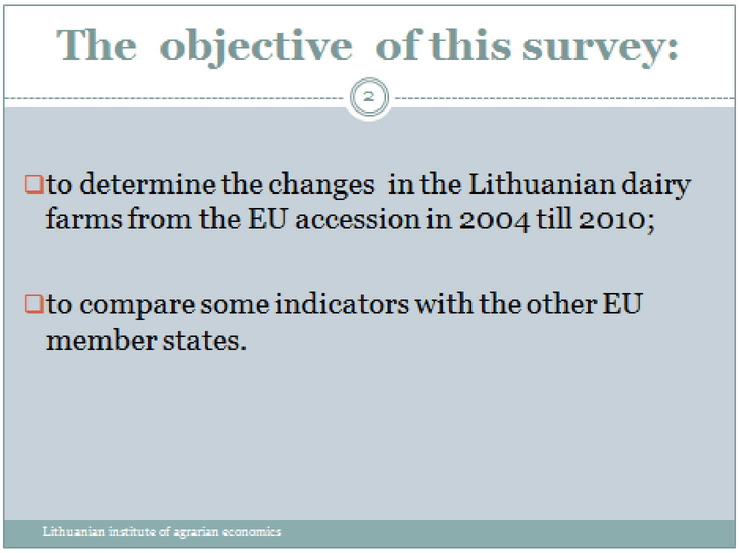
- Enterprise
- Innovation
- Competition
- Investment (*Physical capital*)
- Skills (*Human capital*)

Thank you for your attention.

6 Lithuanian dairy farms business - evaluation of the economic performance indicators

Rima Daunyte and Arvydas Kuodys





Some indicators of the Lithuanian dairy sector, 2004 and 2010

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Indicator	2004	2010	2010 compared to 2004, per cent
Dairy cows, heads	451054	380205	84
Farms with cows	193391	92804	48
Milk production, t	1848.7	1736.5	94
Share of milk output in the total output, per cent	21.8	20.4	94
Share of milk product export in the total agro export, per cent	25.7	14.4	56

Structure of Lithuanian commercial family farms (Agricultural Census 2003 and 2010), per cent

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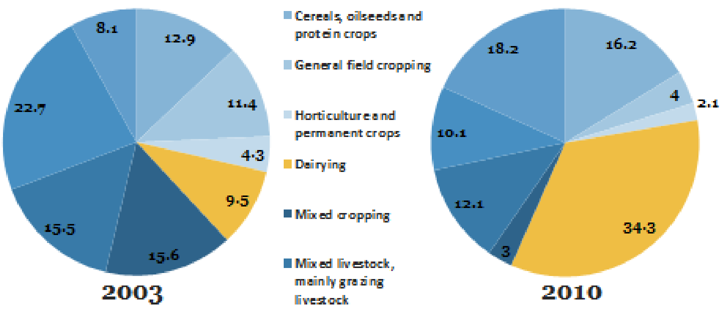

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Methodology

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Selection of indicators were mainly based on:

- surveys from the previous Pacioli seminars;
- Latruffe L. Competitiveness, productivity and efficiency in the agricultural and agrifood sectors. OECD food, agriculture and fisheries working process. No. 30, OECD Publishing, 2010;
- EU Farm economics overview.

Dairy farms were split into four groups by number of dairy cows.

Vitality of the farms was analyzed as the ratio of FNI and opportunity costs. Opportunity costs were calculated using FADN data and information from the Lithuanian bank on annual interests of the securities.

The EU member states around the Baltic sea (the Baltic sea region) were selected for comparison of the farming results in 2009.

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Milk purchasing price by number of dairy cows in the farms (Litas), 2004 and 2010

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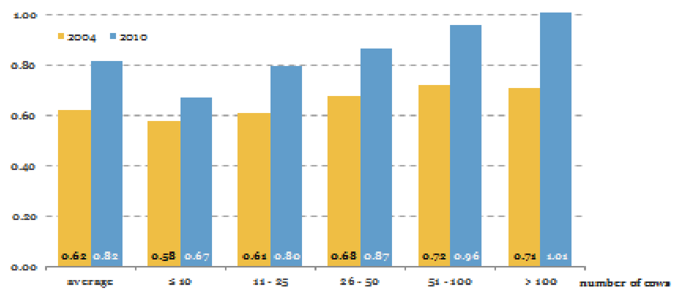

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Changes of milk output, productivity and subsidies in the Lithuanian dairy farms, 2004 and 2010

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Number of dairy cows	Milk output, per cent		Productivity (TO / TI)		Subsidies per 1 ha UAA, times
	quantity	value	2004	2010	
≤ 10	58	68	1.45	1.06	2.5
11 - 25	121	41	1.58	1.24	3.1
26 - 50	95	122	1.63	1.26	2.8
> 50	132	180	1.41	1.26	1.4
Average	**84**	**111**	**1.53**	**1.18**	**2.6**

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Some indicators of the Lithuanian dairy farms, 2004 and 2010

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Number of dairy cows	Assets per 1 ha UAA, Lt		Liabilities per 1 ha UAA, Lt		Solvency (TL/TA), per cent		Liquidity (CA/ShTD), times	
	2004	2010	2004	2010	2004	2010	2004	2010
≤ 10	4173	9243	47	167	1	2	32	35
11 - 25	4485	7276	157	743	3	10	9	8
26 - 50	5595	8306	529	1245	9	15	5	6
> 50	6786	10433	1572	2121	25	20	4	4
Average	**4687**	**8731**	**267**	**829**	**6**	**9**	**9**	**8**

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Changes of some variables in the Lithuanian dairy farms, 2004 and 2010

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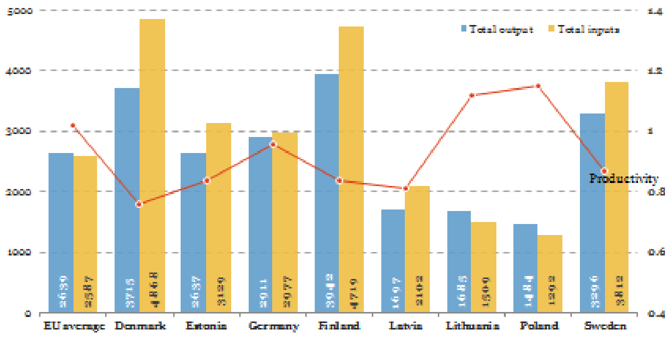
Number of dairy cows	FNVA per 1 dairy cow, per cent	FNI per 1 ha UAA, per cent	ROA, per cent		Vitality (FNI / opportunity costs)		Profitability (FNI / net investments)	
			2004	2010	2004	2010	2004	2010
≤ 10	92	121	6	0.5	1.16	0.78	-	7.5
11 - 25	128	159	14	15	2.04	2.17	20.3	2.2
26 - 50	112	140	19	17	3.82	2.69	6.7	2.8
> 50	133	128	21	18	5.05	3.86	2.0	6.7
Average	**115**	**142**	**15**	**9**	**2.13**	**1.46**	**15.4**	**3.6**

Total output, total inputs per 1 dairy cow in the EU and Baltic sea region (Euro) and productivity, 2009

10



Total assets, liabilities per 1 dairy cow in the EU and Baltic sea region (Euro) and solvency, 2009

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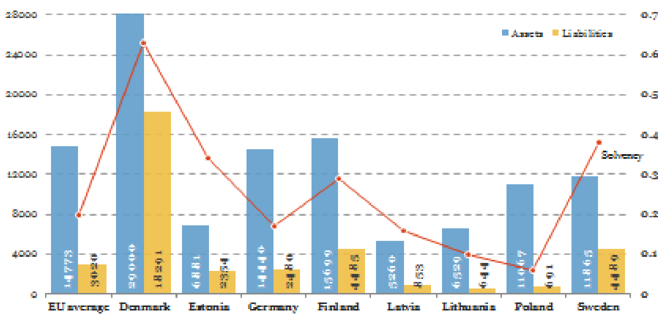

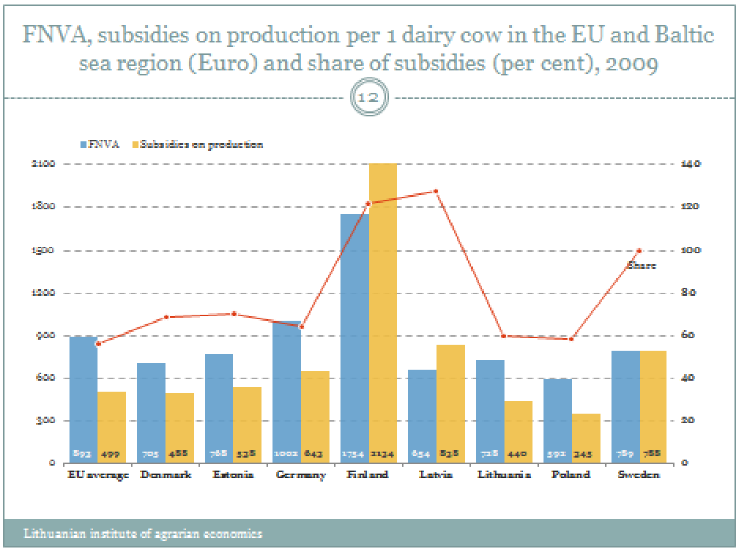
FNVA, subsidies on production per 1 dairy cow in the EU and Baltic sea region (Euro) and share of subsidies (per cent), 2009
12
FNVA
Subsidies on production
Share
2100
1800
1500
1200
900
600
300
0
140
120
100
80
60
40
20
0
892
499
705
488
768
538
1002
643
1754
2124
654
838
728
440
592
345
789
788
EU average
Denmark
Estonia
Germany
Finland
Latvia
Lithuania
Poland
Sweden
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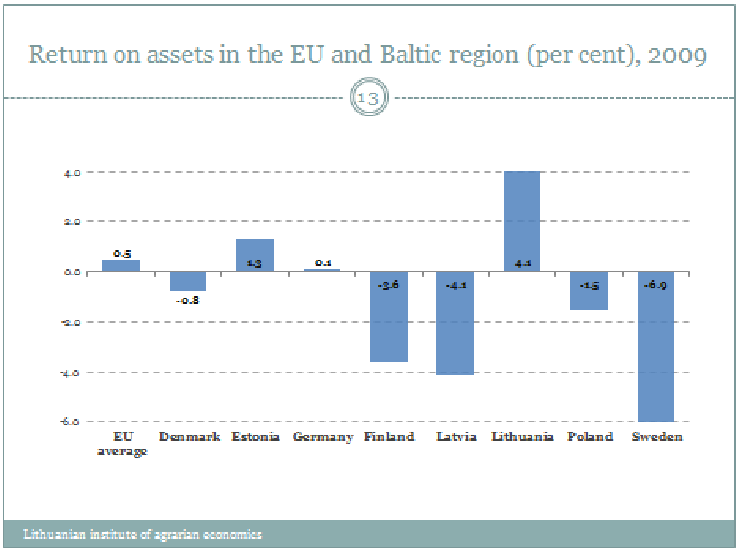
Return on assets in the EU and Baltic region (per cent), 2009
13
4.0
2.0
0.0
-2.0
-4.0
-6.0
0.5
-0.8
1.3
0.1
-3.6
-4.1
4.1
-1.5
-6.9
EU average
Denmark
Estonia
Germany
Finland
Latvia
Lithuania
Poland
Sweden
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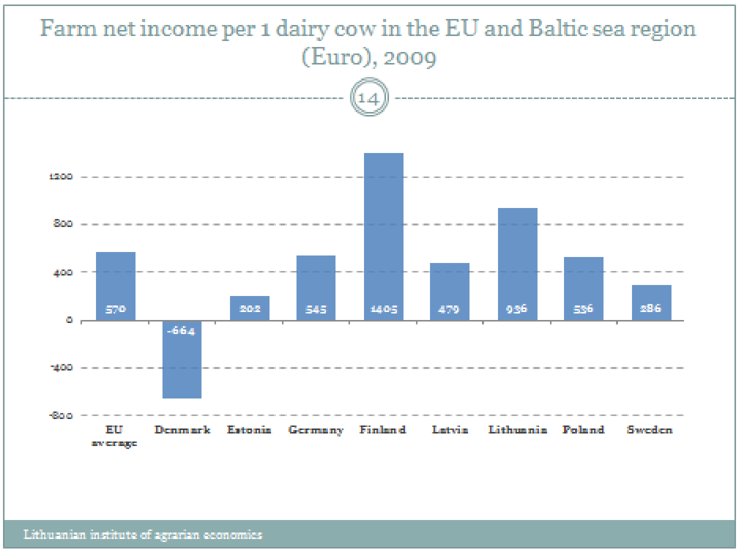
Farm net income per 1 dairy cow in the EU and Baltic sea region (Euro), 2009
14
1200
800
400
0
-400
-800
570
-664
202
545
1405
479
936
536
286
EU average
Denmark
Estonia
Germany
Finland
Latvia
Lithuania
Poland
Sweden
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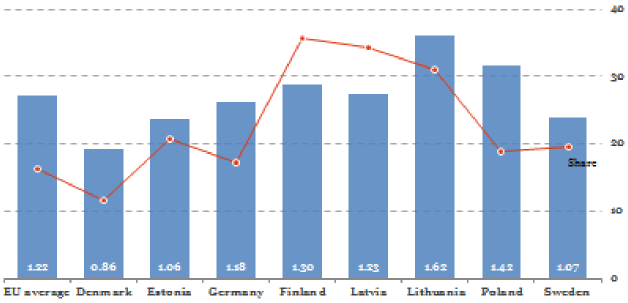
Ratio of total revenue (total output + subsidies) and inputs, share of the subsidies in the revenue (per cent), 2009

15



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Conclusions

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- In Lithuania number of farms with dairy cows decreased more than twice in period between the two Agricultural censuses of 2003 and 2010, however, number of dairy cows and milk production only slightly dropped. On the other hand, number of commercial dairy farms and share of them in the population increased significantly;
- Unfavourable purchasing prices for small dairy farms forced the farmers either reduce or quit milk production;
- Rather good milk production results influenced profound growth of this specialisation. Solvency and liquidity were reasonable good though during this period they fell down. The most significant increase of FNVA per 1 dairy cow took place in the farms with more than 50 dairy cows, however, in the farms with less than 10 cows it decreased. FNI per 1 ha UAA rose in all groups of farms (most in the farms with 11 – 50 cows);
- FNI exceeded opportunity costs in all groups of dairy farms except for the group with less than 10 dairy cows. An average ROA was satisfactory in both 2004 and 2010, however, this indicator declined due to more rapid increase of assets than FNVA. The more cows in a dairy farm – the better ROA indicator;
- Comparison of the commercial dairy farm indicators of 2009 in the Baltic sea region countries showed that the situation in the Lithuanian dairy sector is sufficient good – FNVA, FNI, ROA, solvency, profitability were solid.

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7 Challenges in Collecting Data from Complex Farm Operations: Review of Perspectives from an International Conference

Mary Ahearn

7.1 Introduction

The increasing organizational complexity of farming establishments offers both opportunities and challenges for improving the accuracy of statistical estimates and policy data sets. These complexities can affect data collection, accuracy of estimates, and the use of data, e.g., in multivariate and policy analysis, disclosure, and dissemination of estimates. Recognizing that this situation is commonly faced by statistical agencies across the globe, an international workshop of economists and statisticians engaged in the development and use of economic statistics for agriculture and rural development was convened 26-28 June, 2011 to share experiences and lessons in collecting high-quality farm-level data. The shared goal of the participants was to contribute to the improvement of statistical estimates and data bases for policy purposes.[1]

The meeting began by discussing the uses of the data bases and statistics and the current data collection challenges associated with the increasingly complex agricultural and food sectors. The meeting then addressed the current innovations and potential approaches for future improvements. Organizers and participants expected this to be an ongoing discussion. It is in this spirit that I will describe the issue and progress made at the 2011 workshop at this 20th Pacioli workshop.

7.2 Background

At the same time that economists are demanding harmonized data sets across countries, the structure of agriculture is changing rapidly as the march towards an integrated international marketplace continues. Worldwide small family farms dominate the landscape. In developed countries, however, agricultural production is increasingly concentrated on a small share of farms. For example, in the U.S., in 2007 there were 2.1 million farms. Most of these are small family farms and are vital to rural development strategies. However, only 32,886 of these farms (or 1.5%) account for half of the value of production. The situation is highly similar in other major agricultural producing countries, like Canada, Brazil, and many European countries. In contrast, in many developing countries, small farms dominate production. Complexities in agriculture structure and diversity of structure across countries raise many interesting economic and policy questions addressed by economists worldwide. However, analysis of contemporary agricultural issues is

[1] The workshop was jointly sponsored by the Economic Research Service and National Agricultural Statistics Service of the U.S. Department of Agriculture, Agricultural and Agri-Food Canada, Statistics Canada, and the Farm Foundation. The planning committee was: Mary Ahearn (co-leader), Kevin Barnes (co-leader), David Culver (co-leader), Sheldon Jones (co-leader), Jeffrey Smith (co-leader), Koen Boone, Flavio Bolliger, Bill Iwig, Ashley Leduc, Jaki McCarthy, Jim MacDonald, Joe Parsons, Krijn Poppe, and Daniela Ravindra. Besides the sponsoring institutions, other statistical organizations participating were: the U.S. Census Bureau, Eurostat, the Organization for Economic Cooperation and Development, Food and Agriculture Organization of the United Nations, the Institute for Ministry of Economic Affairs, Agriculture and Innovation of the Netherlands, and the Instituto Brasileirode Geografia e Estatistica of Brazil. In addition, participants included experts from universities and agribusiness, as well as farmers.

hampered by the challenges in collecting and assembling country-specific data on farms and farm households.

The number and organizational structure of farming establishments varies across and within countries.[1] Some organizational attributes of a farming establishment present challenges and new opportunities in the development of agricultural and rural statistics and data bases. These attributes can affect data collection, accuracy of estimates, and the use of data, e.g., in multivariate and policy analysis, disclosure, and dissemination of estimates. We refer to establishments[2] as 'complex' when they pose a high level of these types of attributes in the process of developing statistics and research/policy data bases representative of the target populations.

It is not possible to precisely define a complex establishment or the degree of complexity of an establishment, especially since establishments evolve over time as they optimize their objectives, plus effective complexity may vary by the environmental context. Nevertheless, I will attempt to provide a common understanding of the population of complex farming operations in light of the missions of federal statistical agencies[3], including (1) the uses of the data bases and statistics and (2) the causes of complexity in farming establishments and identification of the organizational attributes of farming establishments that could be considered as 'complex' based on quantifiable characteristics of the establishments. While this paper will make no attempt to describe the challenges posed in the context of systematically managing statistical agency goals and responsibilities, they are certainly an important factor and vary by institution. These agency considerations might include: production and/or management occurring across geopolitical boundaries, disclosure complexity, list frame construction and maintenance, and the use of administrative data that does not perfectly align with data collection procedures.

7.3 Uses

Farm survey and census data contribute to a multitude of end uses, too numerous to describe here. Two general classes of products developed from survey and census data, estimates and data bases. Surveys and censuses are the key information sources for critical production and economic *estimates* developed and periodically released, sometimes by economic class of farm, and often times for standard disaggregated geo-political units, e.g., states or provinces. An important part of the value of statistical estimates is that they are part of a long time series which place the current situation in context. The second type of product developed from survey and census data are *data bases* for policy analyses. Policy analyses are often focused on distributional issues, e.g., they address questions about how current policies have affected economic performance or how proposed policies affect economic performance for certain subpopulations, as well as the aggregate population. For example, what factors influence farmers' decisions about adoption of new technologies, many of which are related to larger household issues? Policy makers must understand farmer decision making in order to institute policies that promote the farmer behaviors they are interested in encouraging. For policy purposes, therefore, it is important to have complete farm-level data because responses to policies will vary by farm and farm household characteristics and the subpopulation of focus will vary depending on the issue.

Experience in the U.S. shows that the average or mean of many indicators mask differences that matter. For example, of the 70 thousand farms with milk cows in 2007, the average dairy farm has 133 cows, but 2.3 percent of farms with 1000 cows or more produced 42 percent of all dairy product sales. Similarly, in Brazil, 40 percent of the largest farms (with 26 hectares or more) account for over three-quarters of total grain, oilseed, and meat production. Ignoring the distribution of economic activity can lead to unin-

[1] There are approximately 2.1 million farming establishments in the U.S., 230 thousand in Canada, 4.8 million in Brazil, and 14.5 million in the EU-27.
[2] We use the terms establishment, farm, and operation interchangeably.
[3] We have a broad definition of statistical agencies, to include economic agencies.

tended consequences for a policy to provide assistance to small farms and fails to provide information about the extent of the farm population in vulnerable financial positions.

Important policy issues in today's world are broad and encompass not just food production, but the rural economy, household incomes and environmental issues such as water quality, water availability, and climate change. Given the complexity of these issues, they often require that data from agricultural surveys and censuses be linked to other data sources, i.e., on communities and natural resources. Hence, farm data should have the capacity to be georeferenced or otherwise linkable to relevant data sets.

7.4 Causes and Characteristics of Complexity

Causes and characteristics of complexity include:

- production contracts
- marketing contracts
- vertical integration
- dispersed asset ownership, management, and returns
- use of farmland
- output sales discovery for open market sales

Many complexities are associated with the size of establishments. Large farms, in particular, are more likely to have more complex organizational structures than traditional, midsized family farms. In the U.S., a long-running trend of increasing concentration of production is expected to continue and this is expected to lead to increasing challenges in future data collection activities. There were 5,541 farms in the U.S. 2007 Census of Agriculture that sold more than $5,000,000 in the census year. All but two states (Alaska and Rhode Island) had farms of this size. The majority of farms in this group produced livestock or specialty crops, and produced more than 25% of the total value of agricultural production. Across all specialties, 449 operations produce 10% of total agricultural products, and 4,009 operations 25% of the total. (See Appendix table for information on the number of farms accounting for certain shares of commodity categories.)

Furthermore, the data collection challenges are heightened for a concentrated industry because estimates from surveys that rely on stratified sampling often require complete enumeration of the largest operations. The levels that qualify an operation as a 'largest' operation vary by survey. In some survey estimates, only a handful of operations may produce a large percentage of the total estimated amount. Maintaining the cooperation of the very large operations in data collection activities is essential to providing accurate estimates, and these are the very operations that must be contacted often for a number of surveys.

Many of the most important policy issues relate to the people engaged in agriculture, and the majority of people in agriculture operate small farms. Extremely small farm sizes can also pose challenges in data collection. Of course, the extent of this issue varies across countries, in part, because of differing definitions of a farm or holding. In the U.S., approximately 25 percent of all farms are point[1] farms. Although some small farms may be start-ups seeking to build their production over time, it is likely that others intend to stay extremely small farms for other financial reasons, such as to lower local property taxes, in-

[1] In the U.S., if a place does not have $1,000 in sales, a 'point system' assigns dollar values for acres of various crops and head of various livestock species to estimate a normal level of sales. Point farms are farms with fewer than $1,000 in sales but have points worth at least $1,000. Point farms tend to be very small. Some, however, may normally have large sales, but experience low sales in a particular year due to bad weather, disease, changes in marketing strategies, or other factors. For farms with production contracts, the value of the commodities produced is used, not the amount of the fees they receive. Changes are made to the point system over time. For example, beginning with the 1997 Census of Agriculture, operations receiving $1,000 or more in Federal government payments were counted as farms, even if they had no sales and otherwise lacked the potential to have $1,000 or more in sales. And, for 2002, a farm that had $500 point value and $500 in government payments is considered a farm.

come tax management, and realization of capital gains on their farmland. The major data collection challenge for the extremely small farms comes, primarily, in their identification as a farm and, secondarily, in the separation of business and household expenses.

Production Contracts

A production contract is a contract in which a producer produces, cares for, or raises commodities not owned by the producer, using land, equipment or facilities owned or leased by the producer, in exchange for payment. A production contract specifies, in detail, the production inputs supplied by the contractor (processor, feed mill, other farm operation or business), the quality and quantity of a particular commodity, and the type of compensation to the grower (contractee) for services rendered. Almost all broilers in the US are produced under production contracts, as well as the majority of hogs, and other livestock sectors. Production contracts are less common in crop production.

For establishments with production contracts, data collection for some items is a challenge because other parties may contribute inputs to the production and the operator may not be able to accurately report either the amount, the cost of inputs, or quality variations provided by others. Similarly, they may not be able to report the value of production. This lack of information seriously hampers the ability of a data user to understand differences in productivity and returns across operations. In addition, because of the competitive nature of the industries involved, there are sensitivities on the part of both contractees and contractors in providing detailed contract information. Even if it were the practice to contact the contractor for follow-up, some values may not be known to them because many contractors are vertically integrated establishments.

Farm establishments can also be the contractor in production contracts with other farms. For example, a livestock operation may contract with another operation to feed/raise livestock it owns and markets. For accurate accounting of net returns, the livestock sales will be included with the returns of the operation and any expenses paid by the operation for this service must be included in expenses.

On the other hand, some single data series, particularly inventory data, may be easier to collect when production contracting is adopted. If one entity owns the livestock raised on a number of contract operations, it is necessary only to contact the owner of the livestock to estimate inventories, not the person raising each barn of chickens or hogs. Production contracting is one type of complexity that is related to farm size—large farms are more likely than small farms to engage in production contracting.

Marketing Contracts

Under marketing contracts a producer enters an agreement with a downstream handler to deliver a specified commodity, with specified qualities, at a certain time period, for a specified price or pricing mechanism. Since the producer retains control over production decisions he or she is able to provide information on production decisions, including input prices. Hence, marketing contracts do not pose the same data collection challenges as do production contracts. However, data collection challenges in marketing contracts can arise when the final output prices are not known at the time of data collection due to a complex pricing mechanism or lags in marketing that occurs over multiple periods.

Most of the production marketed through marketing contacts is on relatively large farms, but a small, and increasing number of small farms, use marketing contracts. For example, marketing through community supported agriculture (CSAs) or having a predetermined arrangement with a restaurant to deliver product are types of marketing contracts.

Vertically Integrated Operations

Vertical integration combines successive stages in the production and marketing process under the ownership or control of a single establishment or firm. Vertical integration poses challenges in data collection because some data items, most notably commodity prices, may not be defined, as they are in open markets. For example, production prices are usually defined at the farm gate. If an operation controls production from the field to the retail chain, a farm gate price may never exist. For example, a livestock slaughterhouse acquiring a cattle operation to better manage their supply target for slaughter is a case of vertical integration.

Individual establishments may engage in multiple marketing channels, further complicating data collection and estimation. For example, an operation that grows grapes for wine may sell some grapes on the wholesale market, and keep a portion of the crop to make into wine (i.e., downstream vertical integration). The value they receive for the wholesale grapes may not be equivalent to the value for grapes kept for value-added processing if the operation chooses to keep higher or lower quality products for in-house activities.

Most of the product produced by vertically integrated firms is from relatively large firms. However, some small farms engage in a type of vertical integration, such as an apple orchard that produces and sells its own cider. The sales of the cider are treated as income of the farming operation, i.e., farm-related income. This also implies that there must be a clear understanding of when a processed or value-added product should be considered as income of the farming operation.

Dispersed Asset Ownership, Management, and Returns

There are many reasons why an establishment might have multiple asset owners and managers for farming operations. For one, the start-up and expansion costs in farming can be quite high, especially given the price of land. Just like in any business, a farm producer may seek investment partners, some of whom participate in some or all of the management decisions. Since a priority use of data for policy purposes is the development of well-being estimates for farm operator households, if all operators are part of the same household, contacting the farm business can also allow for farm operator household information to be collected. When a farm has multiple operators who do not share a household, developing well-being estimates for all farm operator households requires a follow-up to the farm operators who are not principal operators to determine their households' nonfarm income, net worth, and household characteristics. (The additional contacts have never been made in the U.S.)

Since farmland has historically been a very sound investment, it attracts outside investors, who do not participate in the management of the operation. Sometimes these investors invest in land management companies, contracting out the land management activity, and the companies then rent out farmland. Additionally, farming across the globe is generally a family business and is often left to multiple heirs. Oftentimes, heirs will sell their shares to the principal operator, but not always. For example, among Black farmers in the U.S. it is not uncommon for small farming operations to have many non-operator owners, all of whom are descendants of an earlier land owner. This is sometimes referred to as fragmentation. Data collection for non-operator landowners requires a follow-up visit—last done in the U.S. in the 1999 Agricultural Economics Landownership Survey.

Another cause of dispersed, and complex, farm ownership patterns is the result of government farm programs that set certain limits on the types of farming organizations that can participate in programs, such direct payments programs. In the U.S., corn producers receive the greatest share of direct payments and cotton producers receive the greatest per-acre payments. Although effective payment limits are quite generous to producers, some of the largest producers choose to reorganize their businesses so as to avoid the limitations. The effect of payment limit avoidance is to produce more organizational complex establishments with more sharing of ownership, management, and returns, thereby complicating data collection efforts.

Similarly, the organization of farming establishments may become more complex through the increase in owners and managers as a result of owners' motivations to (1) reduce tax burdens resulting from income tax laws and inheritance provisions and (2) reduce legal liabilities. This has implications for how farm operators and owners receive income from the farm establishment. For example, operators of C-corporations do not receive the net income of the farm as a sole proprietor would, rather they might receive dividend income or wage and salary income and might chose to retain some of the earnings with the farm business.

If an operation has many operators and/or many owners, data collection can be difficult for a variety of reasons. In the U.S., an operator is defined as the person(s) making day-to-day decisions for the farm operation. While the existing definitions of operators and operations facilitate the current approach to list building, the current concepts may no longer be reasonable concepts for some complex farms. For example, a complex operation may consist of multiple enterprises (perhaps in multiple locations) with separate managers for each enterprise. For example, a dairy farm that produces its own crops might have a crop manager and a cow manager. It may also have an accountant or bookkeeper, who manages business records, a human resource manager who controls information about employment and a marketing manager, who makes decisions about pricing and sales, as well as a general manager with overall control of the operation. For a given survey, it may be difficult for a single respondent to provide data for the operation and difficult to identify which respondent can respond to different data items for an establishment. Different persons involved in the operation may even provide alternative responses to survey questions. In addition, the contact person might change more often than a smaller operation with a single owner/operator. Perhaps most problematic, when there are multiple owners and managers, is tracing the net returns of the farming establishment that accrue to each of the parties. This is further complicated by the fact that data collection efforts in very complex establishments sometimes rely on fairly low-level staff to complete survey instruments, while most educational outreach efforts are geared at farm managers, farm owners, or high-level professional staff.

Use of Farmland

Land management companies rent out land to farm establishments, offer services to farmland owners, and have varying degrees of involvement with agricultural land. If some of the land they manage is managed by them as a place that qualifies as a farm, they are part of the farm population to be sampled. For farmland that is rented out or managed in some manner for multiple farmland owners, a land management company may be the best contact for some information that is collected on surveys and censuses of farms.

Some farm establishments rent-in grazing land on a per-head basis from private and public organizations. In this case, a farm operator may not know and be able to report how many acres are being used exclusively for their purpose; the best source for the acreage information may be the entity renting-out the grazing rights. Land rented on a per-head basis can be rented from public or private agencies, industrial corporations, grazing associations, and from individuals under a short-term grazing arrangement. Knowledge of acres rented on a per-head basis is critical for land use statistics. Accuracy of land use statistics has increased in its importance because of international concerns regarding climate change and potential climate change mitigation policies. For farm financial analysis, being able to accurately measure farmland as a production input is essential.

Output Sales Discovery for Open Market Sales

Collection of the value of sales for commodities sold on the open market is a basic economic data item for any farm survey or census. However, there is some evidence that the ability to collect this basic item varies by commodity and region. This is because, for some commodities in some regions, the value of sales may be net of marketing expenses, rather than gross of marketing expenses. Given that there may be variation across establishments about how best to collect sales (and marketing expense) information, the preferred approach is not clear. This question has been a long-running question for ERS and NASS experts in the U.S. Currently, the two major U.S. farm data collection efforts, the quinquennial Census and the annual ARMS, take differing approaches.

Some establishments market their output through grower cooperatives. It is not uncommon for producers in cooperatives to not have final sale information for their product at the time of data collection due to a lag in sales. Payments for product sales can come in the form of cooperative dividends. (The lag in information on commodity sales under a cooperative is not unlike the situation for sales under marketing contracts.) In the case of some commodities, e.g., rice, the cooperative receives the government farm payments on behalf of the grower and government payments are transferred by the cooperative to the grower along with dividend payments. In some situations, cooperatives do not attempt to separate out the source of the returns between product sales and government payments. Clarification of the sources of cooperative payments would require direct contact with the grower cooperative or administrative records.

7.5 Broad Implications of Workshop

Appendix A provides a brief abstract of each workshop presentation, and full papers are available upon request for many presentations. General conclusions from the workshop include the following:

- The opportunities and challenges for improving the accuracy of estimates and policy data sets in an increasingly complex agriculture will depend on the use and type of data required. For certain items in sectors dominated by production contracting, for example, inventory data may be relatively easy to collect. One contact with the contractor may be enough to collect individual inventory data for many contractees. Similarly, collecting acres rented on a per-head basis for individual farms and ranches may be collected by contacting public and private grazing agencies.

- There is considerable interest in adopting data collection approaches that target important and complex observations in the statistical universe and tailor data collection approaches to jointly consider the requirements of both the respondent and data collector.

- Data collection from administrative sources, while minimizing respondent burden and data collection costs, may increase the cost associated with the coordination of the process to link these data to individual farm records. For policy analysis purposes, accurate data must be available at the farm-level because flexible distributional information is essential.

- Increasing complexity generally means collection of farm financial data will be more difficult. For example, with production contracting, a price may be impossible to obtain at the farmgate, since the contractor owns the livestock until sold to retail markets. Or, for whole farm financial accounting, when multiple parties have an economic stake in the operation, it may be necessary to make multiple contacts to ascertain the full picture of the economic health of the farm. Increasing concentration in production also implies that contact with the very largest operations be managed strategically and systematically across surveys.

- Complex farms are not all large farms and while production is increasing concentrated on large farms (especially bound for export markets or further processing), in many countries, the number of small farms is increasing. Examples of complexities that may arise in data collection from small farms includes financial and use information for sharing of large, expensive farm machinery, increased home use or bartering, diversity of production mixes and input management, and diversity of marketing channels. By their nature, small farms are more difficult to identify for list-building purposes, as well.

Identifying improved data collection approaches is a dynamic process because complexities are continually evolving. Continual sharing of learning experiences among economic and statistical agencies will allow for the development of recommendations for improved data collection and better position agencies to inform the important decisions of the day. Moreover, this will lead to improved capacity to harmonize data sets across the globe, something that is at the core of the Pacioli mission, and likely to be of increasing importance in the future.

Appendix A. Abstracts of presentations made at the 2011 International Workshop

US Perspective: Daniel Sumner, Professor, University of California, Davis and the Director of the University of California, Agricultural Issues Center, previously Asst. Secretary for Economics, USDA
Abstract: Agricultural establishments are and have long been complex in many dimensions. Relevant data and analysis must develop in ways consistent with complexities for the analysis to be relevant to current and future agricultural issues.
Increasingly economists are turning to specialized sources collected to help determine important parameters. The presentation reinforces the main points through a series of examples of quite different data collection efforts: animal welfare; hedonic pricing and identification of willingness to pay for product attributes; supply elasticities for corn and soybeans incorporating rotations and spatial heterogeneity. Often data analysts are driven by supply chain, environmental and other issues which mean linking farm data up the marketing chain and back down to resource use.
The Netherlands Perspective: Krijn Poppe, Chief Science Officer at Ministry of Economic Affairs, Agriculture and Innovation and LEI Wageningen, UR, The Netherlands
Abstract: Policy research seldom needs yearly census data; yearly income and other data from a panel is enough in The Netherlands. The presentation provides numerous suggestions for the building of data sets including: Using econometrics as a substitute for data gathering, collaborating with industry (and their datasets), the use of IT to get electronic data, the use of standard definitions (in the 90% of the cases where this is possible), and develop those standards where needed. The presentation emphasized the importance of showing distributions of data and clearly defining the farm unit and how it is integrated into the food chain.
Developing Country Perspective: Naman Keita, Food and Agriculture Organization, United Nations
Abstract: The recent food crisis and food market volatility have led to a renewed recognition of the critical importance of the agriculture sector as source of economic growth, food security and poverty reduction and improvement of the livelihood of a large proportion of the population in many developing countries. For policies to be effective, they need to be grounded in factual evidence about the sector and make systematic and rigorous use of statistics. However, in many developing countries, the agriculture sector is very complex and evolving rapidly with the simultaneous presence and inter-linkages of several farming systems. This paper reviews the special challenges to data collection in developing countries where there is a wide range of farms, from subsistence family farms to large, modern, market-oriented and highly mechanized systems.
Canadian Perspective: Dave Freshwater, Professor, University of Kentucky and Dave Culver, Chief, Farm Performance and Structure, AAFC
Abstract: Agricultural policy has been unusual in that it has specified the ongoing existence of a desired production unit, the family farm, as a policy objective. But, despite decades of policy intervention, the majority of Canadian farms no longer meet the common definition of a family farm. Yet, for the most part, the data collected on farming seems trapped in the use of the older and simpler concept of the family farm. The paper reviews these issues, emphasizing different challenges depending on the farm size. Both large and small farms have complex organizational structures. Managers of data systems cannot simply focus on doing a better job of understanding how large farms behave, although they certainly must do this, if only because large farms account for the majority of commodity production. Small farms, while less significant for the production of commodities, play an important role in resource use and in generating political support for agriculture.
Discussant: Catherine Moreddu, Senior Economist, Organisation for Economic Co-operation and Development (OECD)
Abstract: The discussion comments focused on four main points: 1) changing priorities in data demand; 2) cost of information; 3) increasing complexity; and 4) distributional issues. As agri-environmental and rural development policies gained in importance in recent decades, more complex information has been needed to evaluate them. These new types of information are at once more local, complex, multidiscipli-

nary and integrated. Recent price movements, however, have prompted renewed interest for market information to analyse price formation and transmission along the food chain, and to identify the causes and consequences of price variability in agriculture. We are all convinced of the need to look at the distribution of variables, but it is not easy to convey distributional information in a printed graph. The comments also ask: Is the household still the unit of analysis for complex farms?

Canada: Jeffrey Smith, Director, Agriculture Division, Statistics Canada

Abstract: The paper presents the challenges facing Statistics Canada in two parts: those challenges faced generally when collecting data in business surveys; and those faced more specifically in collecting data from agricultural operations (surveys of agricultural operations are classified as business surveys at Statistics Canada). Increasing the use of administrative data already provided by agricultural operations appears to be a direction that must be pursued to substantially reduce the amount of surveying. While reduction of survey response burden was acknowledged as a good and worthy goal, it appeared that among the large and/or more complex operations, there is an equally strong (or even stronger) desire on their part for the data collector to 'get it right', that is, to take the time with them to properly understand the operation so that the data which are collected are correct, meaningful and useful. Greater use of technology (e.g., to allow sharing of information, to allow pre-filling of information and only getting updates on changes, etc.) and innovative methods on the part of the statistical agencies would be welcomed by respondents.

Brazil: Flavio Bolliger, Coordinator, Agriculture Division, Instituto Brasileirode Geografia e Estatistica (IBGE)

Abstract: The types of complex establishments that raise major challenges for data collection and making records compatible with the information required in Brazil are related to (a) corporations operating in more than one activity and (b) those with a large number of physical operating units. Special attention should also be paid to cases of large corporate agricultural establishments or absentee individual producers, for which the relevant information should be collected from different places in far-off urban centers and even in a different federative state. The sugar-ethanol sector is the largest example of complex establishments in agricultural statistics in Brazil and so the paper uses this supply chain as an example of the challenges. In the Agricultural Census the information from the sugar-ethanol sector had a special collection procedure. The plants have several agricultural establishments spread over several sectors, making it unfeasible to collect at the census level, causing impacts on planning the sample surveys. In the industrial surveys, this agro-industry still has characteristics that result or may result in overestimating intermediary consumption and underestimating the added value, consequently underestimating the sector's participation in the GDP.

Eurostat's Farm, Agro-environment, and Rural Development Statistics: Marcel Ernens, Head of Unit

Abstract: There is a recognized need for modernization of EU Agricultural Statistics, in part because of the new demands for data on rural development, agro-environmental indicators, and food safety statistics. The presentation reviewed the plans to modernize statistics relating to agriculture in the major areas of (1) primary statistics, like crop and livestock surveys, (2) derived statistics, like economic accounts, and (3) the broad category of related indicators on land use and cover, food safety, rural development, and agri-environmental indicators.

DG Agri's Farm Accountancy Data Network: Thierry Vard, Team Leader Economic Analysis, Microeconomic Analysis of EU Agricultural Holdings

Abstract: The Farm Accountancy Data Network (FADN) was established in Europe in 1965 with an objective to measure farm income and conduct a business analysis on agricultural holdings. This paper describes the characteristics of the FADN and the challenges faced by data collection in the FADN as agricultural establishments become more complex. There remains a focus on income distribution and an increasing interest in measuring competitiveness (e.g., costs of production and productivity), making the representativeness of FADN an issue since FADN is voluntary.

U.S.: Joe Parsons, Senior Research Statistician, NASS, USDA

Abstract: In the U.S., data collection from large, complex farms is handled on an individual basis by the decentralized NASS field offices. In order to gain a better understanding of the approaches that these offices employed and found to be most successful, NASS conducted a survey of local offices to collect views about (1) the challenges and (2) their responses to those challenges. (See also Jaki McCarthy's presentation, based on data from this survey.) This presentation identified a great deal of variation among the local offices in both regards.
Aspects of Complexity: Current and Emerging Issues in Agribusiness, Moderator, Sheldon Jones, Vice-President, Farm Foundation
Abstract: This session featured the unique insights of three agribusiness representatives: George Muehlbach, John Deere; Tom Wegner, Land O'Lakes (presentation posted); and Dewayne Goldmon, Monsanto. Each presentation emphasized the importance of government data on agriculture to agribusiness, e.g., in helping them price their products, and also recommended that government data collection agencies consider utilizing administrative data available from industry sources as a means of reducing burden on farmers. There was also agreement that burden could be reduced by government agencies sharing data amongst themselves.
Aspects of Complexity: Producers Voices on Complexity and Government Data Collection Needs/Approaches, Moderator, Kevin Barnes, NASS
Abstract: This session featured the unique insights of four farmers, each with a different type of business complexity: Kevin A. Green, Cash Grain Producer, Greenview Farms, DeWitt, Iowa (see presentation); Craig Yunker, Vegetable, Mixed Grains, and Sod Producer, CY Farms & Batavia Turf, Elba, NY (see presentation); Beth Kennett, Dairy Producer and Agritourism, Liberty Hill Farm, Rochester, VT; and Stewart Skinner, Hog Producer with Direct Marketing, Stonaleen Farms, Ontario, CA. The farmers kindly shared the details about how their farms are organized, emphasizing the challenges that they would face in responding to standard questionnaires, as they attempt to cooperate with government data collection agencies. For example, Kevin Green's operation makes use of multiple legal entities that separate asset ownership from production activities. Similarly, Craig Yunker's operation is highly complex, in part because of its multiple activities along multiple supply chains. The other two farmers, Beth Kennett and Stewart Skinner have smaller operations and yet their operations are complex in that they are engaged in niche direct marketing activities and nontraditional enterprises, like recreational services.
NASS/USDA's Practices across State Offices, Jaki McCarthy, Research Statistician, NASS, USDA
Abstract: In the U.S., data collection from large complex farms is handled on an individual basis by the decentralized NASS field offices. In order to gain a better understanding of the approaches that these offices employed and found to be most successful, NASS conducted a survey of local offices to collect views about (1) the challenges and (2) their responses to those challenges. (See also Joe Parsons's presentation, based on data from this survey.) This presentation identified a great deal of variation among the local offices, as reflected in field office responses. The presentation drew on the social psychology literature to consider factors that affected response rates, i.e., persuasion, influence, and cooperation.
Administrative Data for U.S. Agricultural Estimates, Ginger Harris, Demographer and Statistician, USDA, NASS
Abstract: This presentation reviewed the current sources of administrative data used by NASS for enhancing and updating the list frame of farmers, including lists of establishments reporting farm income (from IRS, the U.S. Tax Agency) and death lists (from Social Security Administration). NASS has found that aggregate administrative data is most helpful for aggregate estimates (such as, corn acres planted in a certain state and/or county) and most are compiled by summing field level data so are not impacted by the complexity of the organization structure. Problems arise in use when either the definition or the boundaries of the entities do not match between the operational survey program and the administrative data source. The paper drew on the lessons learned from a project using administrative data on government payments. Currently, there is a department initiative to standardize data collection, so farmers only need to report once to USDA for program administration. However, it remains unclear at this point if this includes NASS as a statistical agency, or just the program administration agencies.

Canada's Enterprise Portfolio Management and Large Agricultural Operations Statistics (LAOS) Unit Approach, Francine Lavoie, Chief, Enterprise Portfolio Management Program, Enterprise Statistics Division, and Steven Danford, Chief, Census of Agriculture, Agriculture Division, Statistics Canada

Abstract: This presentation described the Statistics Canada system currently used to collect data from complex farm operations, the Large Agriculture Operation System, or LAOS. Through this program, the data collection for a farmer with a complex operation is coordinated by Statistics Canada so that the same information required on multiple surveys is collected only once. LAOS helps maintain a balance between the need for data and response burden. There was a great deal of interest in the challenges and opportunities of this system for application in other countries.

Lessons from the U.S. Census Bureau's Efforts on the Large Company Contact Program, Bob Marske, Chief, Product Development & Strategic Planning Staff/OEPI, U.S. Bureau of the Census

Abstract: The Economic Census imposes a significant burden on the Nation's largest companies, which have hundreds of locations and must complete a form for each of them. These large companies, which comprise at least 35 percent of the U.S. payroll, are critical to the Census. Because large companies are critical to published data, the U.S. Census Bureau has developed an account manager (AM) program. This program appoints a single contact to help each large company meet its filing requirement. The goal of the program is to help companies understand the census, facilitate use of electronic reporting tools, and accelerate response. While the AM program has been in existence for the past three censuses, the 2007 Economic Census was the most effective in terms of timeliness and unit response. This paper presents background on the AM program, new strategies used for 2007, and plans for the next census.

Translation of Economic Theory into Practical Guidance for Data Collection from Farm Firms and Households: Defining the Target Population and Identifying Relevant Data Items, Jean-Paul Chavas, Anderson-Bascom Professor, Agricultural and Applied Economic, University of Wisconsin.

Abstract: An integrated analysis of data availability, choices, survey cost, and statistical methods can improve the flexibility, precision and usefulness of data collection and analysis. This paper presents a brief overview of these issues, and reviews what statistical theory and econometrics offer as guidance in the process of collecting and analyzing data.

The paper also considers the optimality of data collection and analysis, recognizing the fact that investigators typically have incomplete experimental control. The paper includes a discussion of the definition of a 'farm' for data collection purpose, both from a statistical viewpoint and an economic viewpoint. Arguments are presented stressing the role of microeconomic dynamics, and the need for better panel data to help us assess the role of managerial ability and its effects on economic adjustments to changing market conditions and technology. Unfortunately, panel data are rather rare. Yet, having access to panel data can be quite valuable. At this point, some important issues remain poorly understood in large part due to a lack of annual panel data. This includes the role of managerial skills in technology adoption, the role of human capital in market dynamics, and the role of education in the current obesity epidemic.

A Business School Perspective on Agriculture, David Sparling, Professor and Chair of Agri-Food Innovation and Regulation, Richard Ivey School of Business, University of Western Ontario

Abstract: This presentation emphasized the difference in perspective between a business school and an economics perspective. In a business school perspective, profitability is key. It takes a first person, rather than a third person perspective. Therefore, the focus is on individual decision making and the importance of 'owning' your problem. This is consistent with the farmer's perspective. Both net income to the business units and capital appreciation are key. The paper advocates for a flexible approach to data collection. Because of the focus on individual decisions, a business school perspective finds great value in case studies.

Accounting Practices of Farming Organizations: How they Organize Business Information, Cathy Parciak, President, Quality Professional Accounting Corporation

Abstract: It is important to recognize that farmers will organize their data in ways that meet their needs. This includes their needs to provide data to financial institutions, tax officials, owners, Canada's Agristability/Agriinvest, and other government programs. It is also important to keep in mind that a goal of the farmer is to collect data that will lead to an outcome of producers paying their lowest legal taxes, e.g., many report income on a cash basis. It is very common in complex operations for the assets to be owned by multiple entities; however, they do not get separated out for financial statement purposes. Assets usually include equipment required for custom work, drying facilities, trucks, storage facilities, and even non-farm work. It is common for farms to buy the output of other producers. For example, there are very few large horticulture producers that do not buy other farmers products to ensure that they have enough diversified produce to sell at Food Terminals, etc. The speaker used case examples of farming organizations to explain the complexity of the organizations for data collection and their motivations for their organizational form, e.g., minimizing taxes.

The Role of Empirical Research for the Study of Complex Forms of Governance in Agroindustrial Systems: Lessons from Brazil, Maria Sylvia M. Saes, Guilherme Fowler A. Monteiro, Silvia M. Q. Caleman, and Decio Zylbersztajn, PENSA-USP

Abstract: This presentation discusses the role of empirical research in understanding the complex forms of governance in agribusiness. The authors argue that there are three fundamental levels of analysis: (i) the basic structure of the market, (ii) the formal contractual arrangements that govern relations within the agroindustrial system, and (iii) the transactional dimensions governed by non-contractual means. The authors take account of the impact of the concentration in the segments of the supply chains and business strategies. The article concludes by suggesting some indicators which could be collected by statistical agencies to improve understanding of the complex relationships among agribusiness segments.

Innovations Using Farm Records Systems, Allen Featherstone, Professor and Masters in Agribusiness Program Director, Kansas State University

Abstract: The paper begins by providing a background of the Kansas Farm Management Association and an overview of reasons leading to additional organizational complexity are discussed. The presentation examines two cases of the organizational structures of actual farms in the Kansas Farm Management Association to understand the depth of the complexity and how that complexity may be accounted for to fully understand the implications for data collection. Finally, the paper provides conclusions regarding managing the complexity associated with data acquisition and performance measurement to adequately capture the entire farming structure. To truly have an understanding of the farm management decision making process, the collection of data on the multiple entities, or super farm, of an economic agent is necessary.

New Trends and Challenges: Integrating Variables and Observations from Multiple Instruments and Experiences in the Exchange of Farmer's Financial Data among Accounting Offices, Fiscal Authorities, and Research and Statistical Agencies, Koen Boone, LEI Wageningen UR and Krijn Poppe, Ministry of EL&I and LEI Wageningen, UR, The Netherlands

Abstract: The presentation argues that there is great potential for efficiency gains in data collection. The LEI at Wageningen utilizes many approaches to efficient data collection of complex organizations. Examples included exchanges of data with 5 accounting offices and other private sector firms in the building of the Dutch FADN. For farms for which there is full detail, data are collected from invoices for inputs, bank transactions, and through the linking with other data bases, based on the approval of participating farmers. The presentation also emphasized the importance of harmonizing of definitions, including basic definitions like the farm definition, in order to capture the potential of efficiencies in data collection from multiple sources. There is a large cost in coordinating across all parties to achieve these efficiency gains.

Future Agenda: Where do we go from here? Cameron Short, Acting Director General, Agriculture and Agri-Food Canada; Mary Bohman, Director, Resource and Rural Economy Division, ERS, USDA; Jeffrey Smith, Director, Agriculture Division, Statistics Canada; and Cynthia Clark, Administrator, NASS, USDA

Abstract: The workshop closed with remarks from leaders participating from the four North American statistical and economic government institutions. A common theme was their interest in fostering the solid programs of each of their agencies, concerns about tight budgets, and their appreciation of the efforts of the workshop participants and their expectations that collaboration will continue in the future. **Cameron Short** (RAD, Ag Canada) raised numerous questions about how policy analysis should be conducted with the increasingly complex farm organizations. This is an important question to answer as solutions to the challenges of data collection are addressed because it should be the major driver of solutions. He also mentioned the importance of looking at distributions, rather than simple averages. **Mary Bohman** (RRED, ERS, USDA) indicated that we must change our approaches to data collection continually as the structure of agriculture changes. Although ERS and USDA believe the whole range of data collection activities have value, her comments were focused on the ARMS. The core use of ARMS is income, but the breadth of the information lends itself to many uses. She indicated that ERS is engaged in a complementary activity focused on reviewing alternative approaches to developing financial statements which also must deal with the complex nature of many farm organizations. **Jeffery Smith (**Ag Division, Stats Canada) emphasized the importance of customized collections, such as with LAOS, and expects to expand that effort. The shift to customized collections shifts some burden from the respondent to statisticians in government agencies. He emphasized that administrative data are fragmented and we can not necessarily assume they are always accurate. There will likely be an increased reliance on Census data as surveys are reduced. There has been a recent initiative to expand access of data to researchers and for commercial applications, although micro data are limited. **Cynthia Clark** (NASS, USDA) reported that she had gained insights from the workshop that she believes have implications for many of NASS' programs. NASS currently is researching respondent burden and nonresponse bias, which is highly relevant to the complex farm issue. A major practice to reduce burden is sample manipulation across surveys by allowing field office leaders to not collect data from some organizations for some surveys. NASS currently does not have guidelines for how field offices should handle data collection for complex farms, and they are allowed to use their discretion to identify samples as office holds for a variety of reasons. She believes that NASS should be writing procedures on how best to handle these decisions. Procedures should be informed by research, for example, a study by business schools could be beneficial and a better understanding of the value of administrative data (e.g., cooperate with EPA in California).

8 How to deal with large complex farms in Denmark

Henrik Pedersen

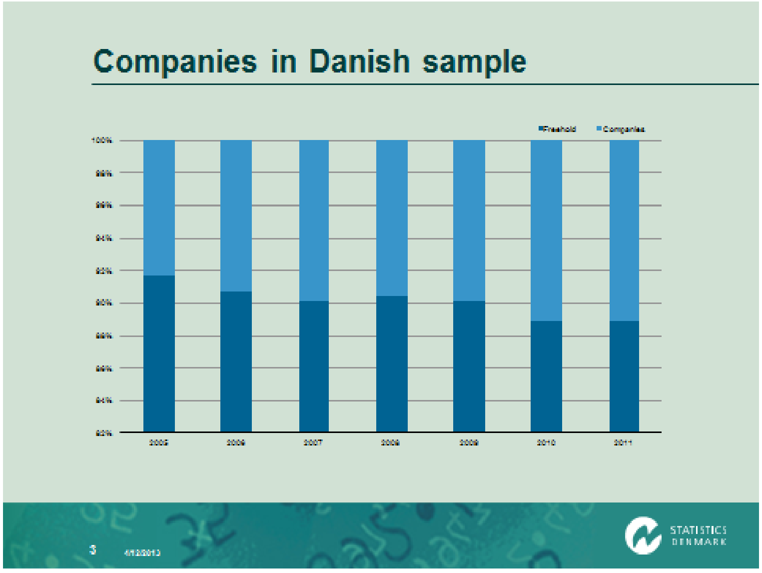
- 'How to deal with' is understood as how we handle large **and** complex farms in a statistical FADN concept.
- Large farms are not a problem in themselves - often we have bigger problems with small farms. They have a higher drop out ratio and often a not very specialized production.
- The problem or difficulty with large farms occurs when the organization of the farm changes from freehold to partnership or even a company structure.
- This presentation is about how we handle large farms in Denmark organized as partnerships or limited companies.

In historical time freehold, - the principle of one man one farm (family farm) - has been the back bone of Danish agriculture.

The problem with large and complex farms is increasing. Why?

- Because farmsize continues to grow to take benefit of economies of scale. This is aided by an ongoing liberalisation of the farm law which over time has allowed one man to own more property and area.
- The average size of farms and especially the average size of big farms is a challenge to the freehold family farm.
- There is a need of professional board of directors in these big farms and especially there is a large (and impossible) need for capital, when a young farmer wants to start on his own or in case of succession.
- The average assets of a Danish full time farm amounts to approximately 6 million Euros, and when we look at large dairy- or pigproducers the average assets amounts to between 10 - 14 million Euros.

Quite a large sum of money for a young farmer who wants to establish himself.



When you take a look at the Danish sample for FADN it is clear in a relative short period freehold has diminished and more farms are organized in some kind of a company. In 2011 we have 11 per cent in our sample as companies.

Types of ownership in 2011 sample

Type of ownership	Per cent	Avg. SO, Euro
Freehold	89	675.000
Partnerships	7	1.350.000
Limited companies	4	2.450.000

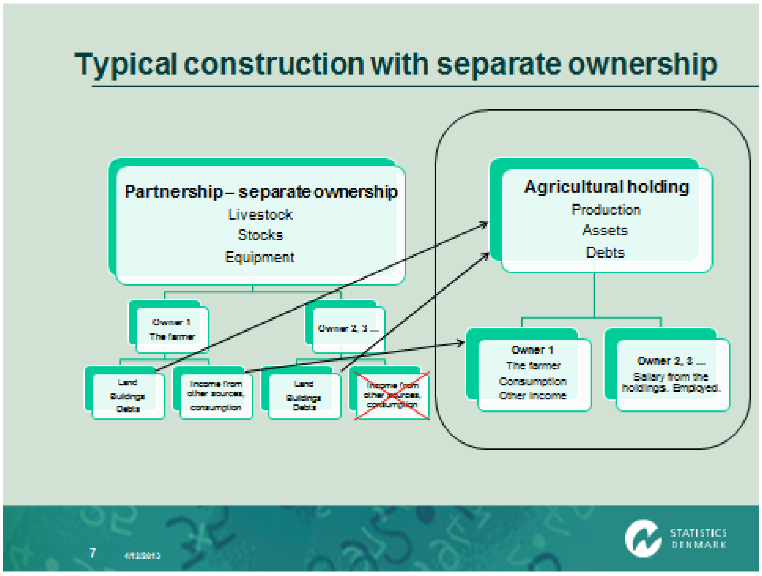
When we look at the types of ownership in the 2011 sample
89% is freehold
7% partnerships
4% limited companies
The average size doubles from freehold to partnerships and also about doubles when we look at limited companies.

Degree of ownership not freehold, 2011

Type of farming	Avg. no. not freehold	-"- large holdings
Crops	7%	26% (>500 hectares)
Milk	9%	28% (>200 cows)
Pigs	7%	15-26% (>500 sows)
Horticulture	19%	-

Looking at the distribution of companies at different types of farming it is quite evenly spread, but look at the percentage of large farms: Almost one out of four is organized as a partnership or limited company.

In principle we have to different types of partnerships:
Joint ownership or
Separate ownership
In the first case the account has the desired amount of information and is not difficult to handle.
In the second case each of the partners owns land and buildings and rent it out to the partnership. In a construction like this it is always a question if the rent for land and buildings is market based or the rent is fixed due to other terms.
Because of this and because we prefer to show/have information on all of the farms assets and debts and cost of financing we use the following model.

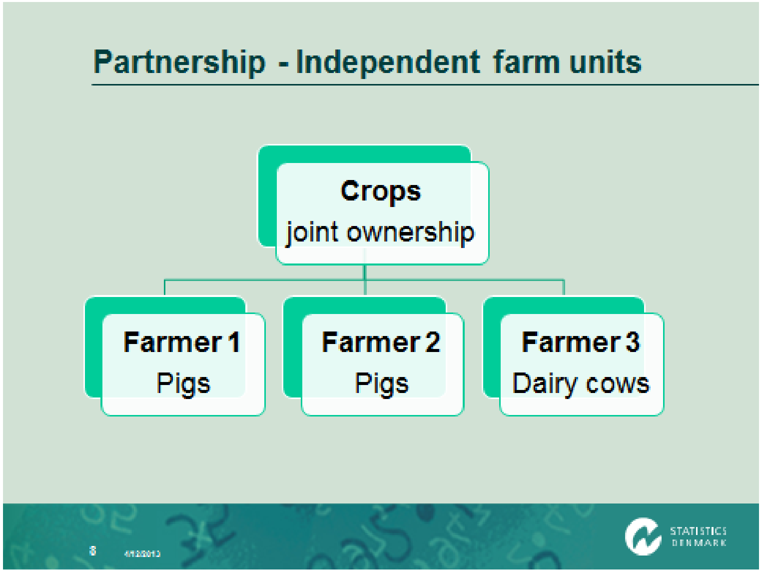


In this case we have a partnership with separate ownership:
The farmers involved has separate accounts with rent from the partnership, agricultural assets, debts, cost of financing and pirvate consumption.

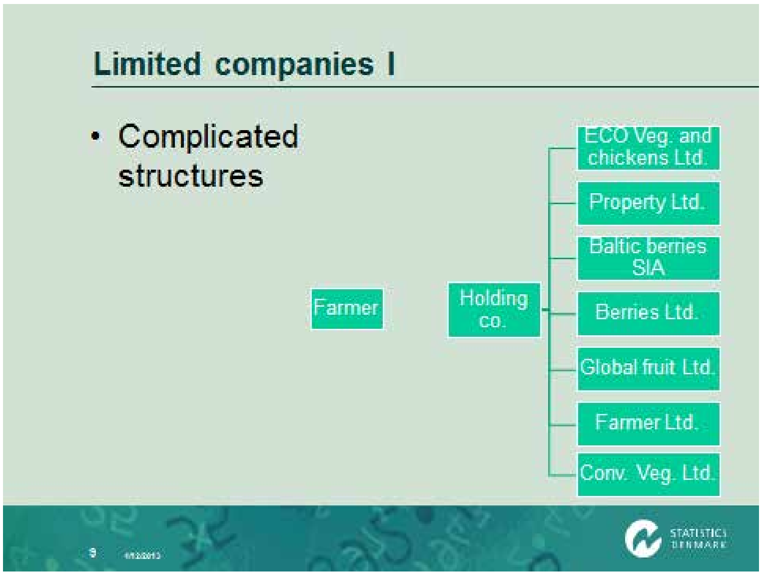
- When an account for a partnership reported to our FADN office we ask the local accountant for the private accounts.
- We then define the farmer as one of the partners and incorporate information from his private account.

- We also incorporate assets, liabilities and cost of financing for the other partners which is regarded as employees in the agricultural holding.

The result is a farm account comparable to other accounts for freehold agriculture.
But it is a timeconsuming, difficult and manual proces!

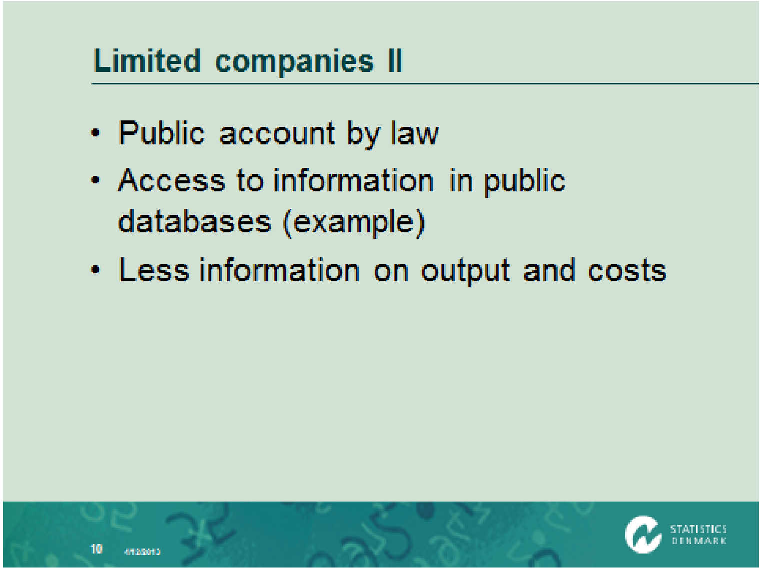


Another situation is when for example 3 farmers with animal production creates a partnership with crop production on their land.
In this situation all farmers have their separate lot in the population and thus a chance to be selected to our sample.
Thus we do not make any attempts to merge them.



When it comes to even larger farms organized as limited companies it is getting even more complicated. This is an example from the real world, where a farmer through a holding company has 7 companies related to agriculture.
What is our agricultural unit? Actually in this case 5 of the companies is occupied with renting out of building or trade with vegetables and fruit.

But two of the companies is occupied with organic and conventional vegetable production and is regarded as separate farm units.



When we look at limited companies there are some options that we should be better to take advantage of:

- They all have to deliver a public account by law.
- These accounts is accesible through public databases

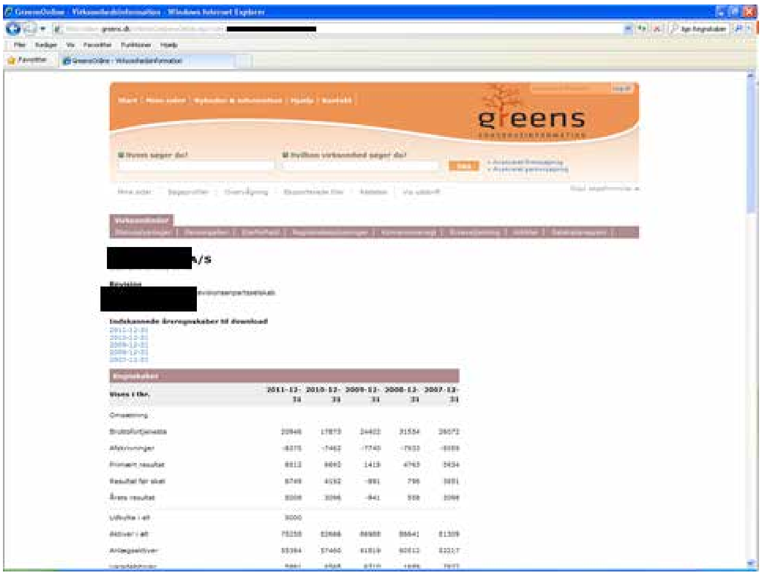
The limitation is that the information in the account is on principal items so for example the details on output and costs are very limited.

But to get more secure estimates on net profit it could be an idea to collect these accounts on a systematical basis.

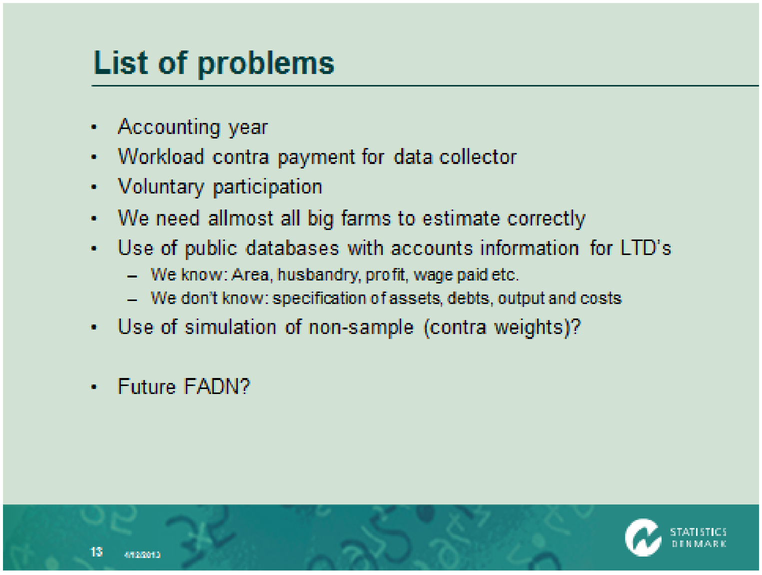
Just an example of public database with accounts for limited companies.

You can search by the identification number of the company or part of the name, adress etc.

The most important sheets are with the corporate structure and …



… the sheet with account information.
There is a standard table with account information for 5 years
and it is possible to download the real account also for 5 years.



- Large complex farms is a challenge to FADN both in context on voluntary participation and the ability to pay enough for the account information.
- Also we NEED big farms to estimate correctly.
- Therefore we need to look for smarter solutions: Use public database information, use of statistical information from single payment scheme, areas, husbandry etc.
- We could might use simulation af missing information.
- In the end (future) we could might provide a full dataset for Danish agriculture, thus making weights unnessary.

9 The use of data for policy analysis and the measurement of sustainability

Thia Hennessey

REDP

Background

- History of using FADN data for policy analysis
- Emphasis has been on the economic impact of policy
- Changing – greater interest in
  - the economic analysis of environmental policies
  - the impact of policy in general on sustainability
  - Important role for FADN
- Report results & experiences of a completed project – thoughts for further research

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Broadening Interest

- Environmental policies becoming more important
- Greening of the Common Agricultural Policy
  - First universal and common policy
  - Very divergent impacts
- Greenhouse gas issues
  - Reduce by 20% by 2020
  - Important for Ireland
- Increasing demand to measure the impact of policy on sustainability
- How do we measure it?

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Measuring Sustainability

- Three main elements
  - Economic, environmental and social
- Irish FADN data
  - Economic – very good
  - Environmental – good
  - Social – poor but difficult to measure
- Developed Indicators for Ireland – charted these historically and linked them to our policy models

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Measuring Sustainability

Broad Areas	Indicators	Measurement
Economic	*Viability*	% of farms (binary)
	Reliance on Direct Payments	% of income
	Coupled Returns	€/ha
Environmental	*Methane Emissions*	Kg/farm
	Organic N	Kg/Ha
	Organic Phosphorus	Kg/Ha
Social	*Demographic Viability*	% of farms
	Isolation	% of farms

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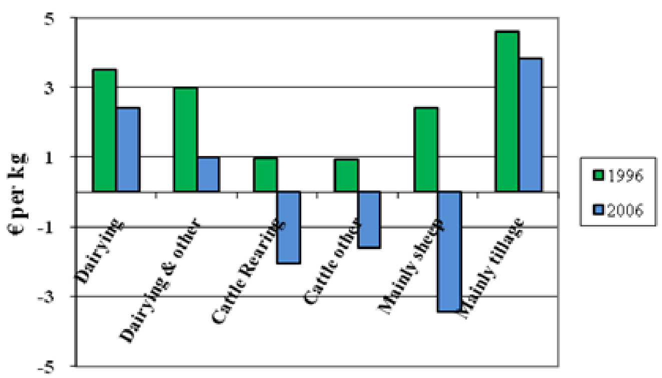
Measuring Sustainability

Coupled Returns € per kg of Methane



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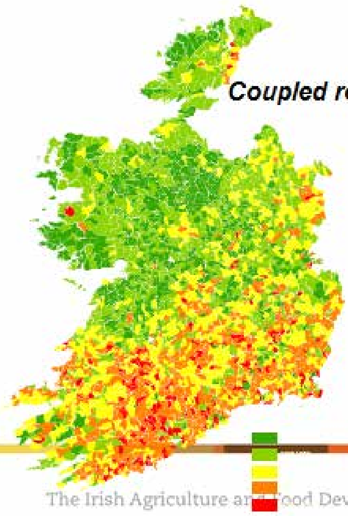

Coupled returns per hectare

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REDP

The problem of dissemination

- Over 20 indicators of sustainability
- Charted historically, modelled policy impacts and linked to policy models
- Show impact of milk quota removal on economic indicators, environmental and social
- Information overload
- Composite indicator??
- Used principal component analysis
- Problematic – economic versus environmental

The Irish Agriculture and Food Development Authority

REDP

The way forward

- Currently re-examining our indicators with environmental specialists
  - Existing dataset
  - Broadening dataset
  - Checklist approach
- Use indicators to examine technologies – are there win-win results?

The Irish Agriculture and Food Development Authority

Importance of FADN for reporting

REDP

- Targets to reduce greenhouse gas emissions
- Research on abatement technologies
  - But must be recognised in “national inventories”
- Need national objective data source
- FADN will be useful in this regard
- Increase collection of “non economic” data

Teagasc

The Irish Agriculture and Food Development Authority

Conclusions

REDP

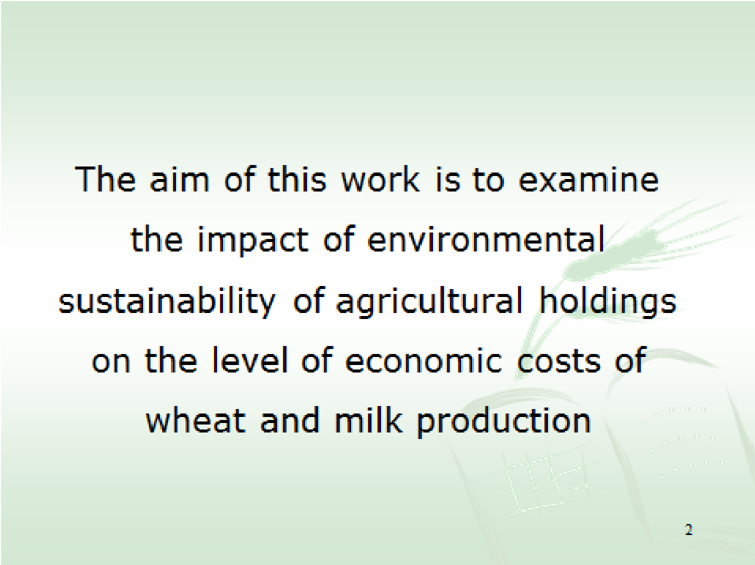
- Policy analysis is changing
  - more focus on environmental policies and measuring sustainability
- Crucial role for FADN in ex-ante analysis and ex-post monitoring
- Need to examine variables required
- Need to think about dissemination
  - we can measure sustainability but how do we explain it?

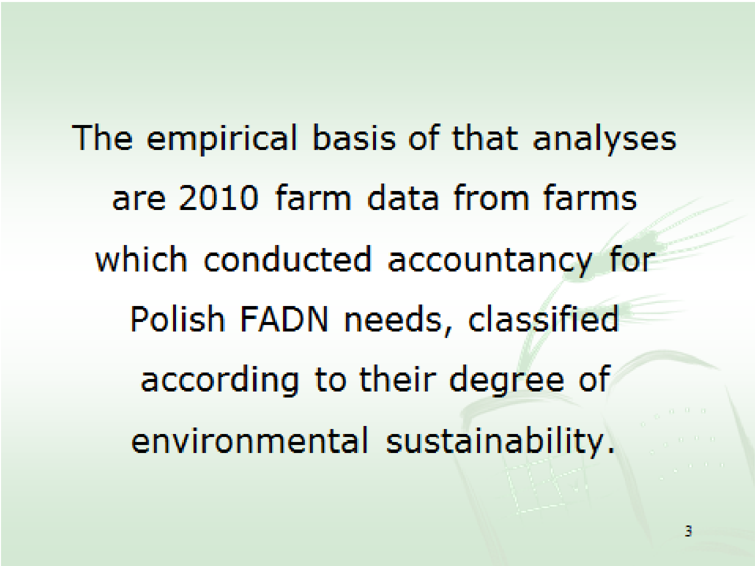
Teagasc

The Irish Agriculture and Food Development Authority

10 The effect of environmental sustainability on the economic cost of farm milk and wheat

Lech Goraj





For the analysis of unit costs of milk and wheat production an own developed method adapted to the accounting database of Polish farms has been used.

The analysis was conducted on the basis of data from 1,131 farms specialized in milk production, in which the share of milk in output was at least 80% and 683 farms specialized in field crops, in which the share of wheat was at least 50% .

4

In the present study, the method of measuring of environmental sustainability developed by Ms. Wioletta Wrzaszcz was used.

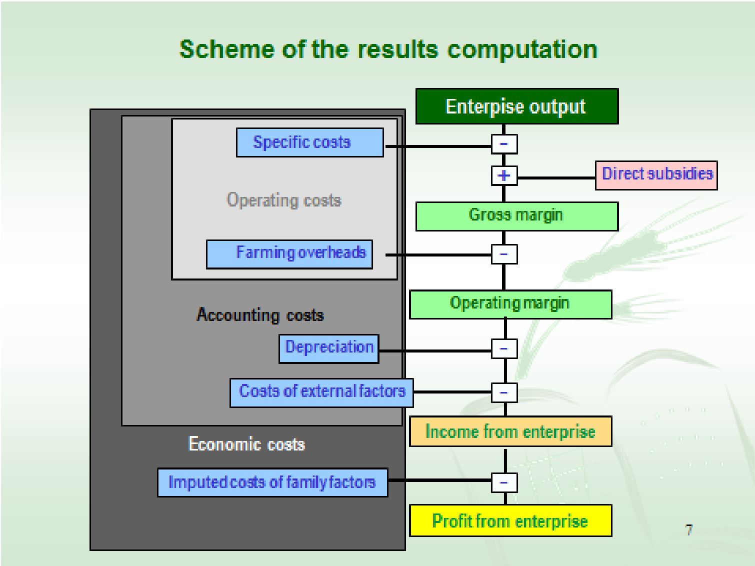
To determine the sustainability of the farm, she choose those variables, that reflect both the positive agricultural practices (within the adopted recommendations) as well as negative impacts on the natural environment.

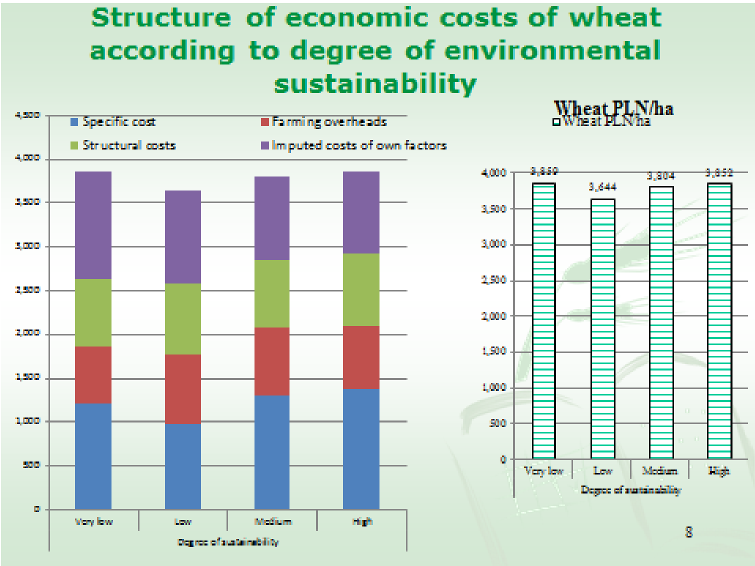
5

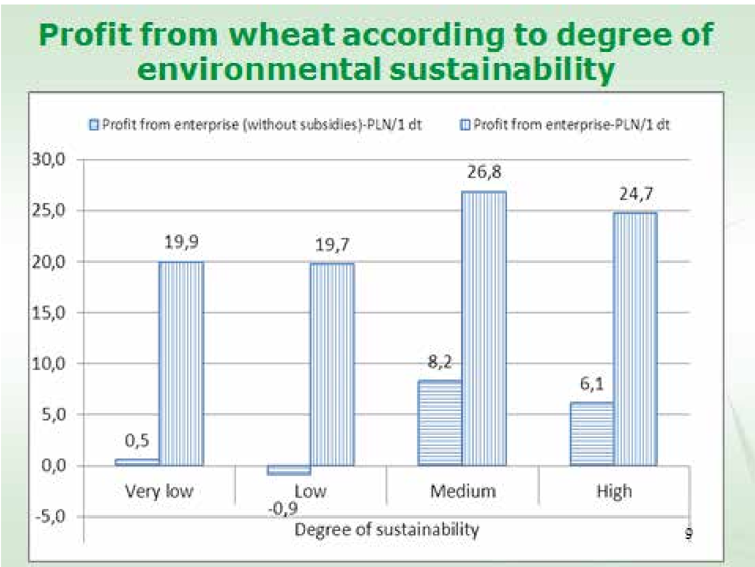
The level of environmental sustainability has been defined by it as the average normalized value of six selected diagnostic variables:

a) the number of groups of plants grown on arable land (ST-stimulanta),
b) the coverage ratio of arable land vegetation in winter (ST),
c) the balance of organic matter in soil (ST),
d) the share of cereals in crop structure (DST-destimulanta),
e) the livestock density on the unit of area of agricultural land (DST),
f) the balance of nitrogen in the soil (NT-nominanta).

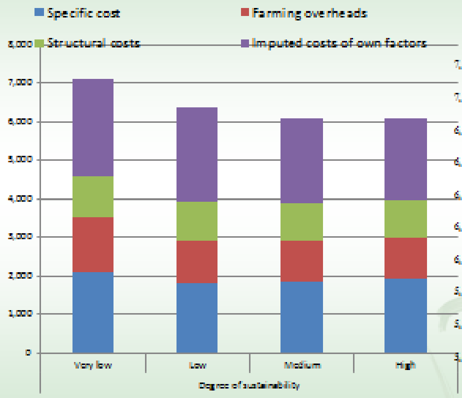
6

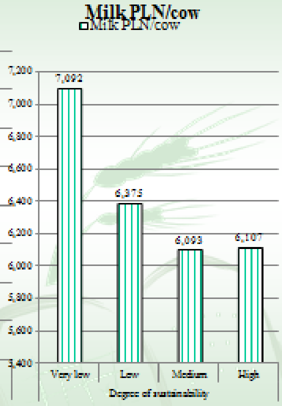

Scheme of the results computation
Enterpise output
Specific costs
Direct subsidies
Operating costs
Gross margin
Farming overheads
Accounting costs
Operating margin
Depreciation
Costs of external factors
Income from enterprise
Economic costs
Imputed costs of family factors
Profit from enterprise
7


Structure of economic costs of wheat according to degree of environmental sustainability
Specific cost
Farming overheads
Structural costs
Imputed costs of own factors
Very low
Low
Medium
High
Degree of sustainability
Wheat PLN/ha
Wheat PLN/ha
3,644
3,804
Very low
Low
Medium
High
Degree of sustainability
8


Profit from wheat according to degree of environmental sustainability
Profit from enterprise (without subsidies)-PLN/1 dt
Profit from enterprise-PLN/1 dt
30,0
25,0
20,0
15,0
10,0
5,0
0,0
-5,0
0,5
19,9
-0,9
19,7
8,2
26,8
6,1
24,7
Very low
Low
Medium
High
Degree of sustainability
9

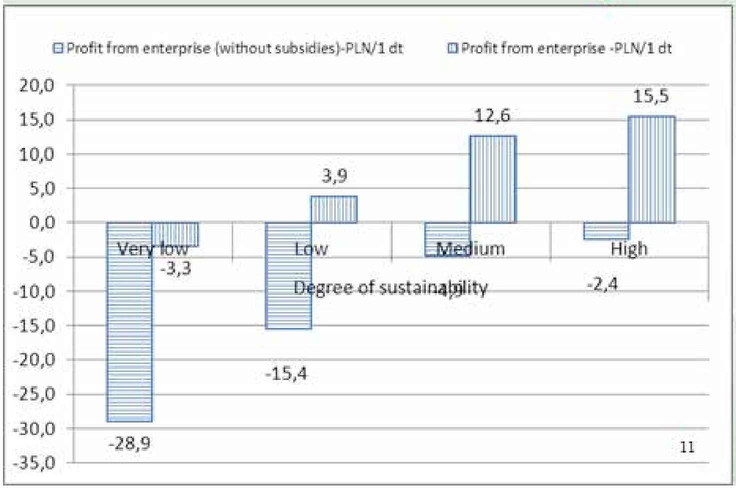
Structure of economic costs of milk according to degree of environmental sustainability





10

Profit from milk according to degree of environmental sustainability



11

Conclusions

Analyzed economic results of farms specialized in wheat and milk production, with varying degrees of environmental sustainability differed significantly.

12

Conclusions

Calculations have shown that the economic cost of wheat production on farms with different degree of environmental sustainability were on the same level.

In milk production, is visible the clear trend of decreasing the economic costs with increasing farms sustainability.

13

Conclusions

Results of analysis indicate, that friendly to environment organization of farms oriented in milk is favorable to producer as well as to society.

That kind of benefits are not visible in farms oriented in wheat.

14

Conclusions

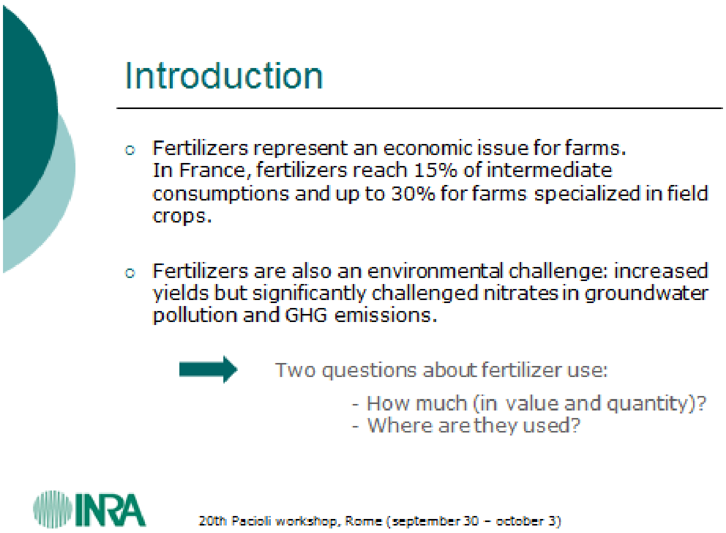
Subsidies obtained by all groups of farms had a significant impact on the level of income realized by three groups of dairy farms. They have changed a loss into a profit.

At the same time these subsidies significantly reduced differences between the economic performance of farms characterized by different degrees of environmental sustainability.

15

11 Econometric estimation of fertilizer use for wheat and other crops

Nathalie Delame



Available data in France

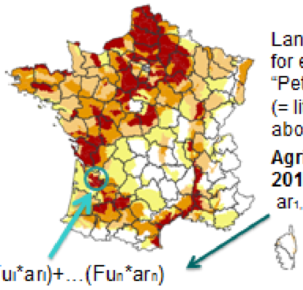
- Values, in euros
  - UNIFA: French professional organization which groups fertilization firms. Every year, they publish statistics about fertilizer sales, available at the departmental level (France counts 101 departments).
  - National account systems publish estimates of expenditure on fertilizer, available at regional level (22 regions in France).
  - French FADN: purchased fertilizers, changes in stocks and then annual consumption ; available at farm level and means are computed at regional level.
- Quantities
  - Surveys on farming practices : type of fertilizer and quantities by individual fields. Mean values are computed at regional level.

Methodology for computing sub-regional data…

Fertilizer use (€/ha) for each crops

French FADN

fu_1,… fu_i ,…fu_n



Land use in agriculture for each "Petite Région Agricole" (= little agricultural area) about 700 in France

Agricultural census 2010

ar_1,… ar_i, …ar_n

$FU=(Fu_1*ar_1)+…(Fu_i*ar_i)+…(Fu_n*ar_n)$

Estimation of fertilizer use, in euros, for each little agricultural area.

This methodology has already been used to estimate pesticides use in France (Butault et alii, EcoPhyto R&D).

Fertilizer use for each crops (FADN)
Estimation by regression

- $Y_f = a_1 . S_{1f} + … + a_i.S_{if} + … + e_f$

List of crops i	
Common Wheat	SBLET
Durum Wheat	SBLED
Barley	SORGE
Maize (grain)	SMAIS
Other cereals	SAUTCER
Potatoes	SPOMT
Sugar beet	SBET
Peas	SPOIS
Sunflower	STOURN
Oilseed rape	SCOLZA
Other oilseeds	SAUTOL
Other fields crops	SAUTGC
Vines	SVIGNE
Apple	SPOMP
Other fruits	SAUTF
Open ground field	SLEGPC
Under shelter	SLEGVA
Flowers	SFLEUR
Other permanent crops	SAUTCP

- With Y = total fertilizer of farm
  CHREN = AUTEN + FOUEN
- With a_i : cost for fertilizer used to produce 1 ha of crops i
- With S_i : area for crops i
- With : e_f error term and f farm index

Forages i	
Fodder maize	SMAISF
Fodder roots	S511
Lucerne	S523_524
Grass seed	S571
Temporary grass	SPT
Permanent pasture	SSTH

7 452 farms in 2010

25 crops

Access to the French FADN database: different ways

- **Individual data on public website**
  http://agreste.agriculture.gouv.fr/enquetes/reseau-d-information-comptable/rica-france-microdonnees/
  - anonymous farm's number: no information about name, localisation (only region). The number is used only to find farms on each period, for panel data.
  - for crops areas, livestock numbers, age of farmer, quota, …
  real quantitiy is replaced by an interval. For instance, instead of 65 Ha, it is 12 (for Total area between 60 and 70 Ha).
- **Individual data on a secure server (CASD)**
  - quantity variables are available.
  - BUT: it is a very long process to obtain access and also very heavy in use.

→ **Question: Is it possible to use databases available on website in our regressions without damages ?**

INRA

Variation lost

- **Intervals** for crops areas are **modified** in a value: we have chosen **the middle of the interval**.

  For example:
  12 for "between 60 and 70 ha" → 65 Ha
  30 for "upper to 400 Ha" → 400 Ha

  The maximum error between original value and approximate value is the middle of the interval.
  Example for common wheat: 2.5 Ha for areas less than 50 Ha, 5 Ha from 50 to 200 Ha, 25 ha from 200 to 400.
- In the **last class,** "upper to 400 Ha", error is unknown. It depends on the maximum value which is not available. In the last class, observations are few and, without limit, original values can be very dispersed.

INRA

Variation lost

	Secure server (CASD)			Web site		
	N	MEAN	STD	N	MEAN	STD
SBLET	4 171	30.1	30.8	4 171	30.2	30.9
SBLED	491	27.4	27.4	491	27.6	27.9
SORGE	2 921	15.9	17.7	2 921	16.0	17.8
SORGE	2 109	19.4	24.8	2 109	19.4	24.8
SAUTI	7 356	92.3	78.5	7 356	92.2	76.3

Source : FADN, Agreste – Calculs INRA

- Difference between the two databases are minimal because, for each variables there are **a lot of intervals** and intervals are **small**.

- Differences are more important for variables with observations in the last interval. Ex: SAUTI

INRA

First estimations of fertilizer use (€/Ha)

Source : FADN, Agreste – Calculs INRA

Estimation with 2 equations (AUTEN & FOUEN) - CASD

	SBLET	SMAIS	SORGE	SMAISF	SSTH
2001	137.85 (4.1526)	168.41 (3.1102)	171.53 (3.9529)	187.43 (3.1139)	27.09 (0.8089)
2002	105.14 (3.4894)	158.77 (3.2540)	158.43 (3.5078)	180.99 (3.3206)	29.12 (0.8006)
2003	105.58 (3.7755)	167.90 (3.3253)	147.90 (3.4115)	145.54 (2.6097)	31.22 (0.6699)
2004	100.57 (3.9097)	175.70 (3.4960)	138.48 (3.7416)	148.43 (2.5696)	32.61 (0.6408)
2005	108.57 (3.7224)	187.76 (3.3629)	144.27 (3.4291)	146.99 (2.7617)	33.47 (0.6543)
2006	109.12 (3.7412)	190.42 (3.3766)	149.68 (3.4615)	145.51 (3.0056)	36.90 (0.7020)
2007	109.39 (4.2182)	204.13 (3.6950)	162.47 (3.9188)	161.33 (3.3751)	36.44 (0.7606)

All coefficients are significantly different from zero.

INRA

20th Pacioli workshop, Rome (september 30 – october 3)

First estimations of fertilizer use (€/Ha)

Source : FADN, Agreste – Calculs INRA

Estimation with 1 equation (CHREN) - CASD

	SBLET	SMAIS	SORGE	SMAISF	SSTH
2001	146.46 (4.3605)	169.28 (3.0820)	164.10 (6.0197)	0.00	0.00
2002	112.97 (3.7054)	158.66 (3.2197)	146.49 (5.6027)	0.00	0.00
2003	107.44 (4.0656)	166.76 (3.2760)	128.63 (5.4995)	0.00	0.00
2004	104.14 (4.2215)	173.24 (3.4569)	122.20 (5.5656)	0.00	0.00
2005	116.26 (4.0191)	186.67 (3.3237)	130.91 (5.5434)	0.00	0.00
2006	115.90 (4.0763)	189.29 (3.5485)	140.70 (5.5720)	0.00	0.00
2007	116.05 (4.5539)	205.12 (3.6712)	152.60 (6.0498)	0.00	0.00

Coefficients for forages are not significantly different from zero.
Split fertilizer between crops and forages gives better results.

INRA

20th Pacioli workshop, Rome (september 30 – october 3)

First estimations of fertilizer use (€/Ha)

Source : FADN, Agreste – Calculs INRA

Estimation with 1 equation (CHREN) – Web site

	SBLET	SMAIS	SORGE	SMAISF	SSTH
2001	143.66 (5.7004)	176.93 (4.3795)	170.61 (8.5523)	148.62 (8.7640)	26.57 (2.2477)
2002	113.16 (4.7594)	164.49 (3.9967)	153.27 (7.2551)	146.30 (8.0778)	31.37 (1.9069)
2003	106.60 (5.4547)	167.60 (4.3497)	127.23 (7.6280)	133.29 (8.1855)	36.61 (2.0060)
2004	100.74 (6.0548)	178.66 (4.9211)	116.35 (8.6002)	142.06 (9.3473)	33.96 (2.1568)
2005	102.99 (5.5462)	187.33 (4.4166)	159.69 (7.7193)	129.45 (8.5712)	35.36 (1.9552)
2006	112.85 (6.0054)	185.76 (5.0545)	151.45 (8.2077)	132.44 (9.0428)	36.06 (2.0119)
2007	122.75 (6.2911)	204.13 (5.1501)	152.25 (8.5183)	124.13 (9.5441)	36.84 (2.1126)

All coefficients are significantly different from zero.

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First estimations of fertilizer use (€/Ha)

Source : FADN, Agreste – Calculs INRA

2007	SBLET	SMAIS	SORGE	SMAISF	SSTH
Estimation with 2 equations (AUTEN & FOREN) - CASD	109.39 (4.2182)	204.13 (3.6950)	162.47 (5.9188)	161.55 (3.3751)	56.44 (0.7608)
Estimation with 1 equation (CHREN) - CASD	118.05 (4.5539)	203.12 (3.6712)	152.60 (6.0498)	0.00	0.00
Estimation with 1 equation (CHREN) - WEB	122.75 (6.2911)	204.13 (5.1301)	152.25 (8.3183)	124.15 (9.5441)	56.84 (2.1126)

Comparison for each year: example on 2007

For the quality of estimations, the split on fertilizer between crops and forages (Y) is more important than using original value or "middle of the interval" for areas (S_I).

INRA 20th Pacioli workshop, Rome (september 30 – october 3)

Conclusion

- To avoid the problem of data access, it is possible to work with database on website.
- This work highlights that the lack of more specific variables (split on fertilizer between crops and forages) is more important than the use of « middle of intervals ».

If it is possible to include FOREN and AUTEN in the web site database, the work can be continued without damages.

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In the futur

- To improve estimations :
  - Add weights
  - Estimate coefficients for each region in order to choose crops in the equations
  - Use panel data

→ Work in progress...

Thank you for your attention.

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12 Using FADN data to estimate agricultural GHG emissions at farm level

Silvia Coderoni, Guido Bonati, Livia d'Angelo, Davide Longhitano, Mitia Mambella, Antonio Papaleo, Silvia

12.1 Introduction

During the last years, issues concerning agricultural greenhouse gases (GHG) emissions mitigation, have become an environmental concern, both at international and European level. At international level the Conference of the Parties (COP)[1], by decision 2/CP.17, requested the SBSTA to consider issues related to agriculture at its thirty-sixth session, with the aim of exchanging views and the COP considering and adopting a decision on this matter at its eighteenth session. At European level, mitigation policies, enshrined in the climate and energy package, have generated a complementary legislation, including the Effort Sharing Decision (406/2009/EC), which governs emission from sectors not covered by the EU-ETS (Emission Trading System), such as agriculture, by setting binding national targets for 2020.

Recently, the European Commission launched, under the Europe 2020 Strategy**,** the initiative 'A Resource efficient Europe' (European Commission, 2011), which contains, amongst others, the Communication 'A Roadmap for moving to a competitive low carbon economy in 2050' with the commitment to reduce EU emissions by 80 to 95%, within 2050, compared to 1990 levels (COM(2011) 112 Final). For this purpose the agricultural sector, if appropriate incentives are set, should contribute with a further reduction of its non-CO_2 emissions by between 42 and 49% (compared to 1990).[2] The facts set out in the Roadmap will be considered in the legislative proposals on the post-2013 CAP. In this regard, within the Commission communication on the future CAP (European Commission, 2010), climate change, has become a priority for adaptation and mitigation issues, related to the role of agriculture as a provider of public goods, including climate stability.

Moreover, recently, the Commission has prepared a proposal on Land Use, Land Use Change and Forestry (LULUCF) accounting (COM (2012) 93 final) in order to consider all land uses in an integrated manner and address them in EU climate policy.

Of course, monitoring of emissions of greenhouse gases has a key role in the tools and policies to address climate change. Therefore, trying to set up a methodology to estimate GHG is a key issue when dealing with climate change mitigation policies.

The aim of the present work is to identify a simplified methodology, using a small amount of data, in order to compute the carbon footprint at farm level, using data from FADN (Farm Accountancy Data Network). Starting from the methodology used in national inventory report to the UNFCCC, which follows IPCC (Intergovernmental Panel on Climate Change) guidelines, this study adopts a cross-cutting approach, that combines the emissions related to different categories (agriculture, land use and energy/fuels).

The research project, using this methodology, aims at providing a tool for two different types of users: a 'generic' and a FADN one. The estimate of GHG emissions of for a FADN user can be computed only by providing the farm code. In the case of a 'generic user', not include within FADN, the estimation of farm

[1] The COP is the supreme decision-making body of the United Nations Framework Convention on Climate Change (UNFCCC).
[2] All this mitigation efforts, have been analyzed on a global scale, taking into account the need to ensure food security to feed the increasing global population, through: 'further sustainable efficiency gains, efficient fertiliser use, bio-gasification of organic manure, improved manure management, better fodder, local diversification and commercialisation of production and improved livestock productivity, as well as maximising the benefits of extensive farming' (European Commission, SEC(2011)289 final. pp.9).

greenhouse gas emissions, is provided only with the input of a few data in a web page (this service is currently under construction).

In this first phase of the research project, emissions for a pilot region (Veneto) have been estimated, to determine the practical feasibility of the tool and possible future implementations. This work will allow, once identified the limitations of the methodology, to propose improvements to FADN dataset in order to fulfil this kind of investigation on environmental impact and provide more robust estimates of emissions and removals of GHGs at farm level.

One of the main added values of this methodology, even in its very first version, is to focus the analysis on the individual farm, using an adaptation of the official IPCC methodology, with a crosscutting approach that combines three different sectors, which are treated separately in IPCC estimates.

12.2 Agricultural GHG Emissions

In order to fulfil the commitments made under the UNFCCC and the European Union's Greenhouse Gas Monitoring Mechanism, every Member State has to prepare the annual National Inventory of emissions and removals of GHG, which is the official tool to monitor commitments (Condor and Vitullo, 2010). The diversified nature of agricultural units is a major problem when estimating emissions, because the agricultural sector is characterized by an extreme variety of environmental and management systems. Therefore, several methods to estimate indirect emissions connected to the different production processes have been developed. Within the UNFCCC, the task of indicating a common methodology to estimate of emissions from all sectors was given to the scientific and technical body of the Convention, the IPCC, that should use simple and available data, because they have to be adopted all over the world for reporting purposes. In Italy, ISPRA (Institute for Environmental Protection and Research) provides the estimation and reporting of the National Inventory of greenhouse gas emissions, prepared using the IPCC Guidelines. According to the ISPRA inventory, the agricultural sector represents in Italy the second largest source of GHG emissions (with 7% of national emissions in 2010), after the energy sector (83%) (ISPRA, 2012).

Since the main objective of the research proposed is to inform and formulate sectoral analysis, and not to identify more sustainable consumption paths (in terms of GHGs emissions), we preferred to use a methodology that refers to the calculation of the carbon footprint (CF) at farm level estimating the emissions at 'farm gate', with a focus on the production processes associated with the farm (natural processes, methods of production, resource management) and not on the consumption of agricultural products. For this reason, the IPCC methodology, that follows a process-based approach, seems to be appropriate to the purposes to estimate emissions that occur within the 'farm gate' and on which the farmer has a 'direct' control. Nevertheless, the choice of adapting the IPCC methodology at farm level could be arguable, as there are many methodologies that allow to estimate agricultural GHG emissions even more accurately than IPCC guidelines. However, IPCC Guidelines represent a standard internationally recognized, are the reference in verifying the compliance with international commitments and provide a widely applicable default methodology, whose efficiency is recognized all over the world (De Cara et al., 2005). In fact, many studies dealing with agricultural GHG emissions estimations made the same choice (See, among others: De Cara et al., 2005; Dick et al., 2008; Perez et al., 2009). Besides, as specified in Dick et al. (2008) the IPCC methodology allows also to uniform accounting for emissions related to agriculture and forestry, which, at national level, have different purposes, can be done in different ways and be based on different indicators, with international level, were they are regulated by the aforementioned IPCC guidelines and follow almost uniform standards between countries.

Another important step, when estimating GHG emissions, also at individual farm level, is defining the system 'boundaries', which can lead to high differences in total emission estimation. Currently there is no international standard methodology to indicate which emissions have to be attributed to the producers and which to the consumers. The choice made for this project was to consider only the direct emissions up to the farm gate related to farm production phase, hence emissions caused by the production of inputs and the transport of food and feed products, are not accounted for. As stated also in other studies (Dick et al., 2008), this approach to the 'farm gate' has the advantage of being able to encourage the use of best practices at every stage of production, to reduce emissions of which the farmer has direct control, and to allow the formulation of policies that are implemented at farm level in order to change farmers' behaviour.

12.3 The Methodology

The methodology proposed for this study, is based on an adaptation of the IPCC methodology (IPCC, 1997 and 2006) at farm level, using Italian emission factors, described in the official documents of ISPRA (various years; Condor et al., 2008) and activity data connected to the main agricultural activities, derived from national statistics. After the first phase of implementation of the methodology, the research project will provide a fine tuning of the estimates, based on the definition of 'farm specific' emission factors (EF), with local conditions and actual management practices.

Scaling down these guidelines at systems with narrower boundaries than national ones, has been done making particular attention to the fact that the object of the estimate are only emissions and removals of GHG that occur within the boundaries of the system (Dick et al., 2008).

More in detail, as regards the 'Agriculture' sector, according to the IPCC methodology, produces emissions mainly of two greenhouse gases: methane (CH_4) and nitrous oxide (N_2O), from six different categories listed in Table 1.

Table1 Emissive sources of the agricultural sector.

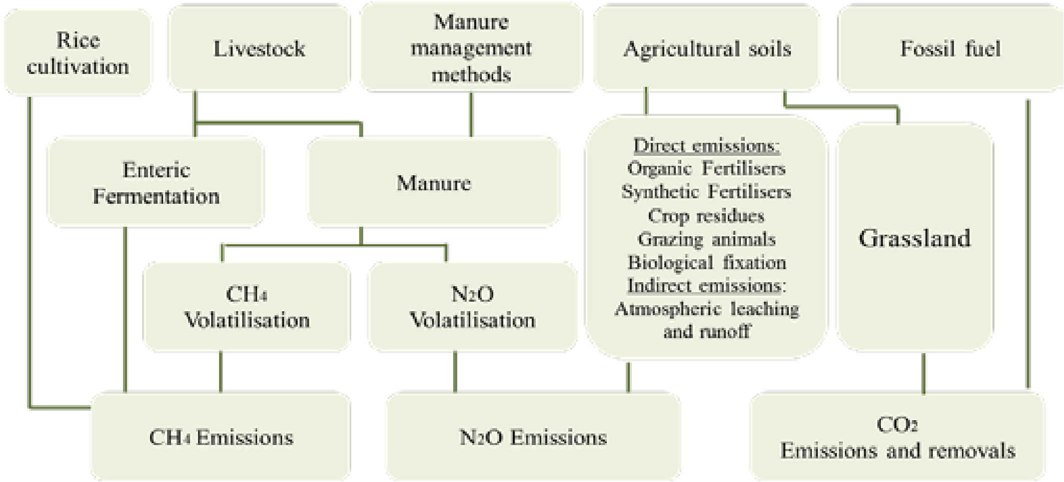
CATEGORY	SOURCE	GHG
4A	Enteric Fermentation	CH_4
4B	Manure Management	N_2O, CH_4
4C	Rice Cultivation	CH_4
4D	Agricultural Soils	N_2O
4E*	Prescribed Burning of Savannas	N_2O, CH_4
4F	Field Burning of Agricultural Residues	N_2O, CH_4

*emissions from category 4E do not occur in Italy
Source: IPCC, 1997.

The IPCC methodology, does not include in the 'Agriculture' category, emissions of carbon dioxide (CO_2) (from the use of machinery, buildings, agricultural operations and transport of agricultural products), that are accounted in the 'energy' sector. Besides, emission and removals of CO_2 from soils and biomass are estimated in the LULUCF sector (Land Use, Land Use Change and Forestry). Instead, with the methodology hereafter described, we have estimated GHG emissions from all sources listed in table 1 less 4E e 4F[1], plus energy and a proposed methodology for LULUCF sector (figure 1). To express emissions in total CO_2 equivalent (CO_{2e}), different GHGs are multiplied by Global Warming Potentials (GWP), using the conversion factors updated over time by the IPCC. To date (ISPRA, 2012) Italy uses GWPs in accordance with IPCC Second Assessment Report, i.e. 21 for CH_4 and 310 for N_2O.

[1] Field burning of crop residues is forbidden in Europe and only Greece and Italy report emissions from this source category. However, CH_4 and N_2O from this source of emissions represented, in 2010, respectively only 0.08% and 0.02% of total GHG emissions for the agriculture sector. Therefore field burning agriculture residues have not been estimated in this study as they were not identified as a key source of emissions.

Figure 1 **Emission sources accounted for.**



Source: Authors elaborations on Wang et al., 2011.

The main value added of the methodology, even in this first version, with country specific EF, is to focus the analysis on the individual farm, using an adaptation of the official IPCC methodology with a cross-cutting approach that combines three different sectors (Agriculture, LULUCF and Energy) that the IPCC estimates separately. Besides, the proposed approach, has the advantage to represent a standardized, easy collection of data on farm activities, that can be used for different agricultural practices for all types of agricultural farms all over the country and also at European level, through the use of FADN. Furthermore, the use of the FADN dataset allows to link GHG emissions to economic indicators, to evaluate emission intensity at farm level.

Generally speaking, IPCC methodology is based on a linear relationship between emissions and activity data. Activity data are mostly taken from FADN dataset and are listed in table 2, for each single source of emission. Country-specific emission factors for each source of emissions are used whenever available in 2011 national communication to the UNFCCC, done by the ISPRA; otherwise, the IPCC default values are used.

Table 2 **Summary of GHG emission sources accounted for in the model**

Emission sources	**Activity data**	**Linked to**
N_2O manure management	Animal numbers	Animal numbers
CH_4 manure management	Animal numbers	Animal numbers
CH_4 enteric fermentation	Animal numbers	Animal numbers
CH_4 rice cultivation	Rice area	Rice area
N_2O agricultural soils		
irect emissions		
Use of synthetic fertilisers	N fertiliser application	Fertilisers consumed
Histosols	UAA	UAA
Manure application	N excretion by animals	Animal numbers
Biological N fixation	Production of N-fixing crops	N-fixing crop area
Crop residues	Reutilization of crop residues	Crop area
Animal production	N excretion by grazing animals	Animal numbers
direct emissions		
Atmospheric deposition	Total N application	Fertilisers and animal numbers
Leaching and run-off	Total N application	Fertilisers and animal numbers

Source: authors elaboration based on De Cara and Jayet, 2005.

The following paragraphs analyze the individual sources of emission, describing the methodology and the data used for each source category.

12.3.1 Enteric Fermentation

The enteric fermentation is the digestive process of herbivores by which carbohydrates are broken down into simpler molecules, to be absorbed by the animal. The amount of methane that is released depends on many factors such as type, age and weight of the animal, quality and quantity of feed and energy requirements. Ruminants (e.g. cattle and sheep) are the largest source of methane from enteric fermentation, while non-ruminants (e.g. horses and pigs) produce smaller amounts of methane (EEA, 2009).

Total methane emissions from enteric fermentation are obtained by multiplying the number of animals[1] by specific emission factors (EF), listed in table 3.

Table 3 Implied emission factor for methane emissions from enteric fermentation (KG/head-1*year-1)

Animal category	IEF ($Kg/head^{-1}*year^{-1}$)
Dairy cows	113,00
Cattle	44,60
Buffalo	63,83
Sheep	8,00
Goat	5,00
Horses	18,00
Mules and asses	10,00
Sow	1,50
Swine	1,50
Rabbits	0,08

Source: ISPRA.

Though this simplified methodology doesn't allow to estimate some mitigation measures that can occur at farm level (like dietary changes or animal genetic selection), it can capture the flexibility of animal numbers that is important for abatement purposes, as changes in animal diet, if not combined with changes in livestock numbers, are likely to provide only limited abatement of emissions (European Climate Change Programme, 2003).

12.3.2 Manure management-methane

During storage and management of manure, CH_4 can be produced and emitted to the atmosphere. In particular the decomposition of manure under anaerobic conditions, through the methanogenic bacteria, generates CH_4. This condition is more likely to occur when large numbers of animals are confined to a small area. The temperature and the retention time in the unit of storage have a significant influence on the amount of methane produced (EEA, 2010).

This category of emissions does not include emissions from combustion of manure and does not take into account the reduction of methane emissions related to the recovery of biogas. For calculating the emissions we consider a simplified method which consists in multiplying the number of animals per animal category, for country-specific emission factor. The following are the values to be assigned as the EF[2] for each head of livestock, to obtain an estimate of the emissions from enteric fermentation.

[1] In calculating livestock GHG emissions using FADN database, as livestock categories are different from those reported in the NIR, a reclassification has been made, in order to include all animal categories and to apply them their specific EF. Tables with the reclassification of animal categories to fit FADN with ISPRA cluster are available under request.

[2] Generally, the value of the EF reported by ISPRA is fixed from 1990 to 2009 (ISPRA, 2011), for the categories animals for which it varies over the years (other cattle, cows and buffalo) was considered the EF 2009.

Table 4 Implied emission factor for methane emissions from manure management ($Kg/head^{-1}*year^{-1}$)

Animal category	IEF ($Kg/head^{-1}*year^{-1}$)	Animal category	IEF ($Kg/head^{-1}*year^{-1}$)
Sow	19,600	Male calves	8,750
Piglets	1,140	Female buffalo	15,250
Pigs 25-50 kg	3,480	Other buffalo	6,290
Pigs 50-80 kg	6,460	Horse	1,480
Pigs 80-110 kg	9,440	Donkeys and mules	0,840
Pigs > 110 kg	13,410	Sheep	0,220
Boars	19,860	Goats	0,145
Dairy cows	15,040	Rabbits	0,080
Other cows	10,660	Laying hens	0,082
Calves	6,220	Poultry meat	0,079
Females calves	7,240	Other Poultry	0,079

Source: Ispra, 2011.

12.3.3 Manure management-Nitrous oxide

During storage and management of manure, N_2O can be produced and emitted to the atmosphere. The term 'manure' is used collectively to include both dung and urine (i.e., the solids and the liquids) produced by livestock, as suggested by the IPCC guidelines (EEA, 2010). As for methane emissions, this source category excludes emissions that originate from burning of manure and emissions from manure deposited on pastures by grazing animals (reported under category 'agricultural soils').

Parameters used for the estimation were: number of livestock species, country specific nitrogen excretion rates per livestock category, the fraction of total annual excretion per livestock category related to a manure management system and EFs for manure management systems (IPCC, 1997). The estimation of N_2O emissions is based on the following equation (IPCC, 2000):

$$N_2O_{4B} = \sum_S \sum_T (N_T * Ne_{XT} * MS_{(T,S)}) * EF_S \qquad (1)$$

where:

N_2O_{4B} = N_2O emissions from animal manure management;

N_T = livestock population for livestock category T;

Ne_{XT} = annual average nitrogen excretion per head and per livestock category;

$MS_{(T,S)}$ = fraction of total annual excretion for each livestock species for the management system S;

EF_s = factor of N_2O emissions for the management system S.

The methodology takes into account the nitrogen excreted in liquid and solid form, using specific values for the ratio kg N_2O -N/kg N, that is 0.001 for liquid systems; 0.02 for solid systems and other management systems (chicken-dung drying process system).

The following table shows factors excretion of nitrogen (N) for each animal category and other parameters used.

Table 5 Nitrogen excretion factors for grazing and hosing for year and head and for manure management system

				kg N excreted ($head^{-1}$ $year^{-1}$)*	
	kg N excreted ($head^{-1}$ $year^{-1}$) housing	kg N excreted ($head^{-1}$ $year^{-1}$) grazing	Total kg N excreted ($head^{-1}$ $year^{-1}$)	Slurry	Solid Manure
Sows	28,13	0	28,13	28,13	
Other pigs	12,92	0	12,92	12,92	
Dairy cows	110,2	5,8	116,00	44	66,2
Other cattle	47,77	0,95	48,72	28,7	19,1
Buffalo	90,34	2,7	93,04	31,35	59
Horse	20	30	50,00		20
Donkeys and mules	20	30	50,00		20
Sheep	1,62	14,58	16,20		1,62
Goats	1,62	14,58	16,20		1,62
Rabbits	1,02	0	1,02		1,02
Poultry	0,53	0	0,53		0,53
Laying hens	0,7	0	0,70	0,1	0,6
Broilers	0,36	0	0,36		0,36
Other birds	0,825	0	0,83		0,825
Fur	4,1	0	4,10		

* excluding grazing

0: the animal is not considered by grazing

- The animal does not produce or does not produce manure or slurry

Source: Data Ispra 2011 and Technical Report 85/2008

12.3.4 Rice cultivation

Anaerobic decomposition of organic material in flooded rice fields produces CH_4.[1] The amount emitted is a function of rice cultivar, number and duration of crops grown, soil type and temperature, water management practices, and the use of fertilisers and other organic and inorganic amendments (EEA, 2009). Italy is one of the 5 member states of UE-15, that reports emissions from this source category. Emissions from rice cultivation are estimated only for an irrigated regime, as other categories suggested by IPCC are not present. CH_4 emissions, represent two water regimes with different emission factors: for 2009 Dry-seeded (single aeration) EF is 24,96 (g CH4/m2*year) and Wet-seeded classic (multiple aeration) EF is 33,67 (ISPRA, 2011).[2] To obtain CH_4 emissions from rice cultivation, each EF should be multiplied for UAA cultivated with rice.

12.3.5 Agricultural soils

Nitrous oxide is produced naturally in soils through the processes of nitrification and denitrification.

One of the main driver of this reaction is the availability of nitrogen (N) in the soil. Hence, N_2O emissions are estimated separately for the main anthropogenic input pathways of nitrogen to the soil: use of synthetic fertilisers; manure application, biological nitrogen fixation; nitrogen returned to the soil by the process of mineralization of crop residues; N from manure deposited by grazing animals on pasture, range and paddock and indirect emissions from atmospheric deposition, leaching and run-off (see Table 2).

[1] N_2O emissions from fertilisation during cultivation are estimated under direct soil emissions - synthetic fertilizers, in the category 4D-Agricultural soils.

[2] For the estimation of CH_4 emissions from rice cultivation ISPRA followed a detailed methodology implementing the IPCC guidelines (IPCC, 2006) and considering country-specific circumstances. The quality of the Italian rice emission inventory was verified with the Denitrification Decomposition model (DNDC) founding a high correspondence with the EFs used for the Italian inventory (ISPRA, 2012).

Use of synthetic fertilisers

Emissions from the use of synthetic fertilizers are obtained multiplying the N content of the fertilizer with the parameters used to estimate the direct emissions of N_2O, as follows:

$$N_2OF_{sn} = N_{tot} \times (1 - FRAC_{gasf}) \times 0.0125 \times 44/28 \qquad (2)$$

where:

N_{tot} = total nitrogen content in fertilizers.

$FRAC_{gasf}$ parameter is calculated according to the IPCC Guidelines (dividing total emissions of NH_3-N and NO_x-N for total nitrogen content in fertilizers).

The main difficulty for estimating this kind of emissions using FADN is concerned to the data on fertilizers used in the farm. Nowadays in Italian FADN fertilizers quantities are not a compulsory field, hence, some farms do not report it. Besides, N_2O emissions from synthetic fertilizers are often underestimated, but FADN future improvement will allow the reporting of data for all farms included in the sample.

Moreover, IPCC and FADN classification of fertilizers are quite different, so to have data on N content in each fertilizers type, a reclassification based on N content, or expert judgment, has been made.

Animal waste applied to soil

The N manure applied to soils is obtained by nitrogen excretion corrected for nitrogen lost by volatilization of NH_3-N and N-NO and the proportion of nitrogen excreted on pasture (Condor et al., 2008), using the following equation:

$$F_{AM} = N_{an\_soil} \times (1 - (FRAC_{graz} + FRAC_{gasm})) \qquad (3)$$

where:

N_{an_soil} is the nitrogen excreted per livestock category; $FRAC_{graz}$ is the fraction of nitrogen excreted on pasture compared to the total excreted; $FRAC_{grasm}$ is a 'country specific' parameter which in Italy is equal to 0.292 (ISPRA, 2011). The F_{AM} parameter is then multiplied by animal number for each category.

Table 6 Parameters used for the estimation of N_2O emissions from grazing animals

Animal category	N excreted kg ($head^{-1}$ yr^{-1}) Housing	$FRAC_{graz}$
Other cows	47,77	0,019
Dairy cows	110,2	0,05
Buffalo	90,34	0,029
Other pigs	12,92	0
Sows	28,13	0
Sheep	1,62	0,9
Goats	1,62	0,9
Horse	20	0,6
Other horses*	20	0,6
Poultry	0,53	0
Rabbits	1,02	0

* including donkeys and mules

Source: Ispra, 2011.

Biological nitrogen fixation

The input of nitrogen in the atmosphere due to the N-fixing crops (legumes and fodder crops) is calculated from the nitrogen fixed by the individual crops (listed in Table 7). Emissions from N-fixing crops (N-f) (N_2O_{N-f}) are estimated using UAA cultivated with N-fixing crops (UAA_{N-f}), the N content fixed by each species and fixed conversion factors of N emissions as follows:

$$N_2O_{N-f} = UAA_{N-f} \times Nfixed \times 0.0125 \times 44/28 \tag{4}$$

Table 7 N content fixed by each species (kg N ha-1 yr-1)

N-fixing crop	N fixed
Bean	40
Fresh pea	50
Dry pea	72
Chickpea, lentil, wolf	40
Vetch	80
Soy	58
Medical grass	194
Clover	103

Source: ISPRA.

Crop residues

The N that returns to the soil with crop residues is calculated both for nitrogen-fixing and other crops, correcting through the coefficients $FRAC_{burn}$ to take into account the share of residues burned. The amount of by-product (dry matter) is estimated for each crop from annual production; or cultivated area; then N content factors are applied for each culture. Using the harvested production, crop residues (F_{cr}) are calculated applying coefficients of ratio residual/production and content of dry matter production. Then, N_2O emissions are calculated as follows:

$$N_2OF_{cr} = F_{cr} \times (1 - FRAC_{burn}) \times 1/6.25 \times 0.0125 \times 44/28 \tag{5}$$

Where $FRAC_{burn}$ is the fraction of crop residues burned rather than left on the field = 0.1 (kg N / kg crop_N). The coefficient 6.25 is used to convert the protein content in dry matter and obtain N content.

Histosols

To estimate emissions from this source category, soil map of Italy was extracted by the geo-database 'Badasuoli'[1]. Crossing this geographic layer with that of Italian municipalities, we obtained 36 municipalities with coverage of histosols greater than 50% of their territory.

Emissions from this category will be calculated only for farms falling in these territories following the next equation:

$$N_2O_H = ha_H \times (8KgN - N_2O) \times 44/28 \tag{6}$$

Where ha_H are the hectars of histosols. As in Italian FADN there are no information about ha of histosoils, they have been approssimated to the UAA, for all municipalities having more than 50%.

Sewage sludge

The amount of nitrogen contained in the sludge is estimated from the amount of sludge scattered on the ground (expressed as dry matter) by the average nitrogen content (between 4% and 5%) of sludge. The emission factor used is 0.0125 kg N-N_2O/kg N and the volatilization factor is 20% for N-NH_3+ NO_x emissions (IPCC, 1997). This emission category has not been estimated for this first stage of implementation, as in FADN there no information about sewage sludge applied to soils.

[1] Developed by CRA-Research Institute for the Study and Protection of the Soil, Florence.

N from manure deposited by grazing animals on pasture, range and paddock

The share of emissions resulting from manure excreted by grazing animals, must be considered among the emissions of agricultural soils (4D). These emissions are obtained through the multiplication of the nitrogen excreted per head for grazing livestock, by livestock population category, by a factor of 0.02 kg N excreted N- $FRAC_{burn}$ /kg (see Table 5 column 3).

Indirect emissions

To estimate indirect emissions due to N inputs from atmospheric deposition nitrogen contained in fertilizers and the total nitrogen excreted by animals are taken into account.

Losses due to volatilization of mineral fertilizers and livestock manure, are calculated using respectively $FRAC_{gasm}$ $FRAC_{gasf}$ factors. The equation used is the following:

$$E = \left[(N_f \times FRAC_{gasf}) + (N_l \times FRAC_{gasm})\right] \times 0.01 \times 44/28 \tag{7}$$

where:

N_f = total nitrogen fertilization

N_l = total nitrogen livestock (housing and grazing)

Emissions from leaching and runoff derive from total nitrogen excretion and nitrogen in fertilizers corrected for the parameter $FRAC_{leach}$ which quantifies the amount of nitrogen brought to the ground by percolation and surface runoff.

$$N_2O_{leach} = (N_f + N_l) \times FRAC_{leach}(0.3) N/Kg \times 0.025 KgN_2O\text{-}N \times 44/28 \tag{8}$$

12.3.6 Energy

The methodology proposed estimates also emissions due to the direct fossil fuel use in agriculture, mainly to produce mechanical energy. To obtain GHG emissions connected to the use of fossil fuels, the methodology takes into account the emission factors used for the transport sector, multiplied for the quantity of fossil fuel used. The EF[1] used were taken from APAT (2003).

12.3.7 LULUCF: an example with grassland

Agro-ecosystems as meadows and grassland play an important role in terms of balance of GHG in ecosystems. In fact, while there are source of direct emissions in terms of CO_2 (animal and plant respiration), CH_4 (enteric fermentation) and N_2O (nitrification and denitrification processes), they also generate flows providing organic carbon sequestration and temporary sink.

The estimation of emissions of LULUCF category using FADN brings several difficulties, because of the timing of accounting of actual physical emissions (e.g. how to count relatively immediate land-use change emissions over time) (Dick et al., 2008). However, the aim of this paragraph is to propose a simplified methodology adapted from IPCC guidelines (IPCC, 2006), to estimate carbon (C) sequestered into soils at farm level using the FADN database.

[1] The EF used were the following: 3.109 kg CO_2/kg burned for gasoline; 3.138 kg CO_2/kg burned for gas oils and 2.994 kg CO_2 /kg burned for LPG.

According to IPCC guidelines, the first step to calculate the annual C stock variation in inorganic soils is the typological identification of soils based on the content of organic matter (OM), distinguishing 'organic' from 'mineral' soils.[1]

The estimation of C stock, according to the Stock-Difference Method (IPCC, 2006), is based on the rate of annual change in carbon stocks in soil (ΔC_s) given by the change in organic carbon in OM (ΔC_o) and the change stock of inorganic C (ΔC_i) in mineral soils, minus the losses for degradation of organic matter (L_o) by microbial in organic soils, that is:

$$\Delta C_s = \Delta C_o + \Delta C_i - L_0 \tag{9}$$

The IPCC methodology is based on two assumptions: first, the C in the soil reaches (after a defined period) a stationary equilibrium spatially defined under certain climatic conditions and management and second, the transition of the stocks of Soil Organic Carbon (SOC) towards a new equilibrium, is a linear process. We focused on mineral soils because they represent the most common category among Italian agricultural land. The content of C in this type of soil depends, besides to climatic conditions, from the management practices that significantly affect the ability of atmospheric C sequestration through changes in agricultural production (i.e., fertilization, irrigation, etc.).

The annual stock changes of organic C (ΔC_o), in a certain period of time (t), can then be calculated as the difference between the content of the last period considered SOC (SOC_t) and the baseline (SOC_{t0}), all compared to the time (D) of the transition period in years between two equilibrium points of SOC:

$$\Delta C_0 = \frac{SOC_t - SOC_{t0}}{D} \tag{10}$$

The fraction of organic C in soil, is determined by the product of the baseline C stock (ton/ha) and specific stocks variation factors, as follows:

$$SOC = \sum_{c,s,i} SOC_{REFc,s,i} \cdot F_{LUc,s,i} \cdot F_{MGc,s,i} \cdot F_{Ic,s,i} \cdot A_{c,s,i} \cdot \tag{11}$$

where c is the specific climate zone; s the type of soil; i the set of land use systems and in the geographical area (e.g. region, country, etc.). The coefficient F_{LU} is factor of variation of C according to the land use system of; F_{MG} is the factor of variation on the system management; F_I is the factor of variation of inputs of organic matter applied to soil (e.g., organic fertilizer); A is area analyzed with the homogenous biophysical conditions (same climatic conditions) and management history. All these factors represent changes occurring in a given period (D) which can vary according to the agricultural systems taken into account and were calculated and classified by the IPCC. In this context, the reference stock (SOC_{REF}) is the estimated values under native vegetation in the first 30 cm of the profile. The values are classified by IPCC on the basis of global climatic regions, according to the type of soil soils. In the case of organic soils, the annual losses of SOC (L_o) depend on the draining processes which imply the gradual degradation in CO_2 due to the oxidation kinetics of OM. The IPCC (2006) estimate this fraction based on an emission factor (EF) in tonnes of C per hectare per year, which varies according to climatic zones as described in the equation:

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[1] The organic soils have a content of OM variable between 12% and 20%, and are typical of wetlands with poor drainage (e.g. peats), while minerals soils generally have a relatively low content of OM and are typical of ecosystems less humid and with good drainage conditions.

$$L_0 = \sum_c (A \times EF)_c \quad (12)$$

Starting from reference values and related factors, one can estimate the average annual change in the stock of organic C according to the type of soil and climate, the farming system and management practices. The values are reported, for each case study, in the IPCC guidelines (2006).

Table 8 summarizes all the various steps that should be analyzed to estimate C stock variation in inorganic soils, at farm level using FADN dataset.

However, there are several critical issues to consider when applying the methodology described using information available in FADN dataset. These relate mainly to the soil management practices history over the last 20 years, since farms sample varies both in sampling and in information analyzed. However, it is possible to make some assumptions. For example, the contribution of the carbon stock variation could be assessed even in shorter periods (e.g. 4 years) using non-linear calculation models available in the literature, assuming the maintenance of agricultural practice for the remaining years (e.g. 16 years). Some management aspects, besides, could be detected through indirect indicators from FADN; for example, fertilizers and other technical means costs, the use of subcontracting, the machinery, irrigation expenses, etc.

Table 8 Steps to estimate C stock variation in organic soils according to IPCC guidelines

1. Identification of the type of soil	Mineral or organic
2. Definition of the time horizon	Represents the interval at which one wants to study the annual C change and depends on data availability and on farm history; generally is around 20 years
3. Identification of the geographical area	Represents the area in which the farm operates, defined by appropriate spatial scale (NUTS 2, NUTS 3 and municipality).
4. Identification of the climate zone	The climate zone is identified according to geographical area and Koppen climate classification. Most of the Italian territory falls within the climatic region 'C' (temperate climate of middle latitudes).
5. Identification of the type of farming system	Use of IPCC guidelines to calculate C stock into the soil in different ecosystems (such as forest soils, agricultural land, meadows and grassland, wetlands and marshes, settlements, other soils - i.e. bare soil, rock formations, glaciers)
6. Distribution of utilized agricultural area (UAA) at farm level	Detectable in FADN database
7. Soil classification (soil type)	Types of minerals soils on which to compute the SOC reference of native vegetation are defined by the International Soil taxonomy-based system WRB (World Reference Base for Soil Resources) or by the USDA. Usually, the information can be found directly from local services of geo-pedological monitoring (i.e. regional office)
8. Reference SOC value under native vegetation	IPCC manual
9. Identification of conversion factors based on management practices	Depends on the type of system (arable, meadow and pasture, etc.) and the level of management intensity (derivable from FADN database)
10. Computation of the annual change in stocks of organic carbon in minerals soils	Use equation (10) based on the time horizon and the information available on the farm history
11. Computation of annual losses of C in the case of organic soils	Use equation (12) after detecting the IPCC emission factor based on the climate zone
12. Calculation of the inventory of carbon stock in the soil according to the annual change in total SOC	Apply equation (9)

Table 9 shows the basic information necessary to approximate the calculation of the change in SOC that can be derived from the FADN database.

Table 9 Scheme of main data required for the calculation of the approximate change in SOC that can be derived from FADN database

Data	**Unit / type of information**
Geographic Zone	Municipality
Agro-ecosystem	Permanent crops / herbaceous /forage
Management intensity	Conventional/Minimun tillage/no-till/etc.
Manure	Yes/No
Irrigation	Yes/No
UAA	Hectares

To make an example of how to apply these steps at farm level, we selected a farm from the FADN database of Veneto region (2007). The utilized agricultural area (40.75 ha) is allocated for approximately 80% to pasture (32.7 ha), while the remaining 20% is allocated to arable land for cereals cultivation (8.05 ha). The land is located in Padua Province, in the municipality of Veggiano that, according to provincial mapping system, belongs to the order Inceptisoils, following USDA classification. Climate is temperate, with hot summers ('Cfa' class, according to Koppen classification). Assumptions on management practices were made according to expenditures for fertilization, pest management, irrigation and mechanization, to get a suggestion on intensiveness of management, in order to correctly define the coefficients necessary for the calculation of C flows.

The annual flows have been calculated for the period 1995-2007, assuming that in 1995 the entire area was allocated to the cultivation of cereal with medium degree of intensiveness. The calculations are summarized in the table below.

Table 10 Example of annual variation of C edaphic at farm level in a soil mineral type

	Geographic zone	*Climatic Zone*	*Pedological tipology*	*Time horizon (Years)*	*Agro-system*	*UAA (ha)*	*SOC$_{REF}$*	*F_{LU}*	*F_{MG}*	*F_I*	*SOC (t C/ha year)*	*ΔCO$_0$ (t C/ year)*
Data	*Veggiano (PD)*	*Warm temperate dry*	*HAC (Eutrochrepts - Inceptisoil)*	*2007*	*Permanent Grasland*	*32,7*	*38*	*1*	*1,14*	*1,11*	*1.572*	***58***
					Cereals	*8,05*	*38*	*0,69*	*1,02*	*1*	*215*	
				1995	*Cereals*	*40,75*	*38*	*0,69*	*1,02*	*1*	*1.090*	
Source	*FADN*		*IPCC Guidelines - http://tornado.provincia.padova.it/WebSit/viewer.aspx?id_applicazione=b32667db-9141-4cde-be63-df4b535ad41a*	*FADN*	*FADN*	*FADN*	*IPCC Guidelines (vol 4)*	*IPCC Guidelines (vol 4)*	*IPCC Guidelines (vol 4)*	*IPCC Guidelines (vol 4)*	*Authors Elaborations*	*Authors Elaborations*

Source: elaboration on FADN Data, 2007.

12.4 Initial Tests of the Methodology

One of the main objectives of this research project is to apply the methodology to all FADN regional online database, obtaining emission data for all farm in FADN through an automatic procedure.

By now, a very first attempt of estimation using the methodology described has been made with Veneto Region FADN dataset, that consists of 695 farms in 2010. For this exercise there is number of emission categories that have not been included due to the lack of data availability (sewage sludge applied to soils and pasture). LULUCF sector emission estimation is still improving because the changing FADN sample doesn't allow to count relatively immediate land-use change emissions over time. Besides, at present, FADN information does not include data on rice cultivation method, so one cannot distinguish between rice field cultivated with single or multiple aeration. To overcome this problem the multiple aeration EF was used, even if, this assumption could represent an overestimate of the related emissions.

Resulting GHG emission values are aggregated in different ways to enable more detailed analysis at farm and production level. The main aggregates obtained are: total emissions in CO_{2e} and by gas; emissions from animal husbandry and agricultural soils, emission related to energy sector.

Total emissions calculated till now for Veneto region FADN sample, amount to 168,248 tons of CO_{2e}. Of course, as IPCC methodology is based on a linear relationship between activity data and EF, the scale effect is predominant when comparing different farm levels of emissions. This reflects in a linear relationship with GHG emission and standard output classes. Besides, the effects of GWP on the level of emissions, makes some activity more emission intensive than others. Generally speaking specialist pigs, poultry, cattle-dairying rearing and fattening combined, have a high importance in terms of GHG emissions. In these cases, also when compared to UAA, a scale effect is still predominant, mostly as a result of intensive livestock farming system.

12.5 IT Tools

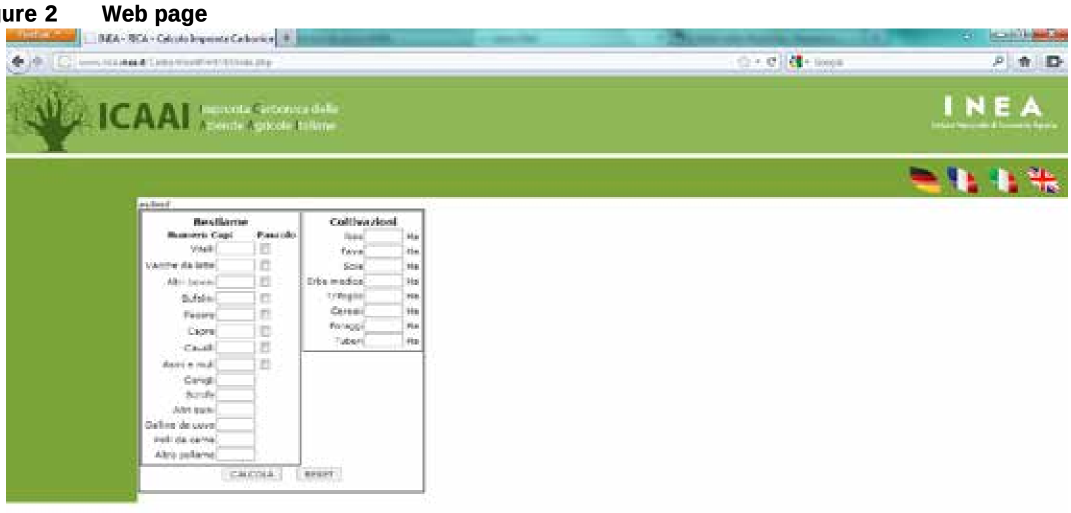
As specified, the carbon footprint methodology can also be applied to any generic farm, not included in the FADN sampling. In fact any Italian farmer could be interested in determining what is the level of emissions of GHG for the crops or livestock in his farm, or to analyse different scenarios with a diversified mix of production processes. It has been decided therefore to make the calculator freely available on the web, in order to provide an easy and fast way to determine the carbon footprint using data input by any user, even anonymously.

Target users for this web-based carbon footprint calculator can be: single farmers, not included in the FADN sample; consulting agencies or farmers' organizations, interested in developing analysis for their members; students in agricultural or environmental sciences; agricultural economists or policy experts, wishing to make some kind of analysis on new policy instruments to mitigate agricultural emissions.

The web-based tools still under implementation, and shares most of the routines developed for the FADN component. The user will have to fill a set of forms on farm structure and location, crops and livestock, inputs (including fertilizers) etc. The final result can be either displayed or sent to the user, in case he provides his email.

This service will be totally free and will also be used to fine tune the whole set of algorithms implemented so far. Figure 2 shows the first page of the web tool, that, till now, is available only in the Italian version (not only because of the language, but also for the use of country specific EF).

Figure 2 Web page



12.6 Concluding Remarks

Mitigation of GHG emissions is becoming an increasing issue also in the agricultural sector, although, in Europe, they have already achieved a significant reduction. However, by 2050, according to estimates of the staff working documents for the roadmap for 2050 (SEC(2011) 289 final), agriculture is projected to represent a third of total EU emissions, tripling its share compared to today. The importance of agriculture in terms of climate policy is, therefore likely to increase, but as there is some potential risk of carbon leakage, the dual challenges of global food security and climate action need to be pursued together, in order to avoid undermining global reduction of emissions.

In other words, it is not only the amount of GHG to be reduced that matters, but the possibility to do it in cost-effective way. In some cases, savings may be made relatively easily at minimal (or no) cost. In other cases, savings may be prohibitively expensive. Thus, as stated by Dick et al. (2008), improving measurement of farm scale emissions should be accompanied by attempts to also improve understanding of the costs of mitigation.

A methodology based on FADN could allow an integrated assessment of GHG mitigation in a cost effective manner, as FADN data are collected for economic analysis. This seminal work is a first step into this direction, but there are still several issues to consider. The following SWOT analysis tries to highlight some of these issues, by clarifying what are the strengths, weaknesses and threats of the proposed approach, and trying to look forward to further improvements or opportunities of future work, in view of enhancing the representation of local environmental conditions and proper management practices, to make the methodology more suitable for inform and develop national agricultural policy, while still allowing harmonisation between national and international data requirements.

Table 11 SWOT analysis

STRENGHTS	OPPORTUNITIES
• System boundaries: only direct emissions at farm gate of which farmer has a direct control • Policies implemented at farm level can be better evaluated • Few input data and simple methodology • EU level dataset • Comparable to UNFCCC estimates (could allow harmonisation between national and international data requirements)	• Fully exploit FADN information and integrate them with other sources in order to describe local environmental conditions and actual management practices • Accounting for all processes within the boundaries that could be neglected an national scale, but relevant at farm scale (i.e. carbon sink for each cultivation) • Measure the possibility of reducing emissions in a cost-effective manner

WEAKNESSES	THREATS
• National average emission factors can hidden some local/farm level improvements and so allow to estimate only gains from few mitigation measures • Incomplete set of FADN information to estimate agricultural GHG emissions (i.e. land use change practices need to be monitored for longer periods. Need for a dynamic approach) • Emission timing: how to account for different times of actual physical emissions (how to count relatively immediate land-use change emissions over time)	• Sustainability assessment of agricultural production should not be related only to GHG estimation • Even an improved calculator, could ignore adaptation measures and synergies between mitigation and adaptation options • Some experts claim that for complete assessments to be undertaken a full cradle to grave LCA may be required

Source: authors' elaboration and Dick et al., 2008.

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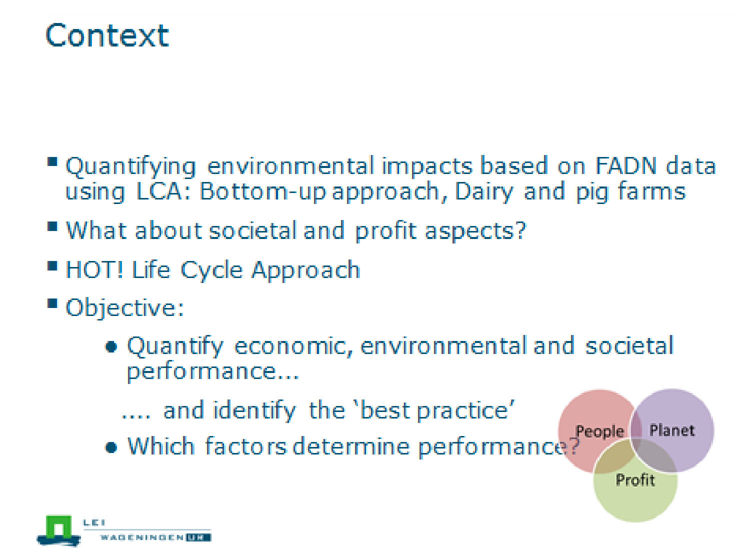
13 Sustainability in the Pig sector

Hans Vrolijk



Introduction (context)

- Pig sector
  - Breeding farms
  - Fattening pig farms
  - Integrated pig farms
  - Other farms

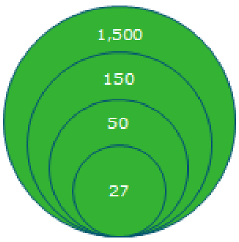
2,120 farms
1,400 pigs

- Important issues:
  - Ammonia emission
  - Animal welfare
  - Economic performance

wide variation

Material & Method (Data)

- Farm Accountancy Data Network:
  - 2009
  - Sample 1,500 farms
  - 150 pig farms
  - 50 fattening pig farms
  - 27 used in this study
    - no other production
    - Farm specific excretion applicable



Material & Method (economic/societal)

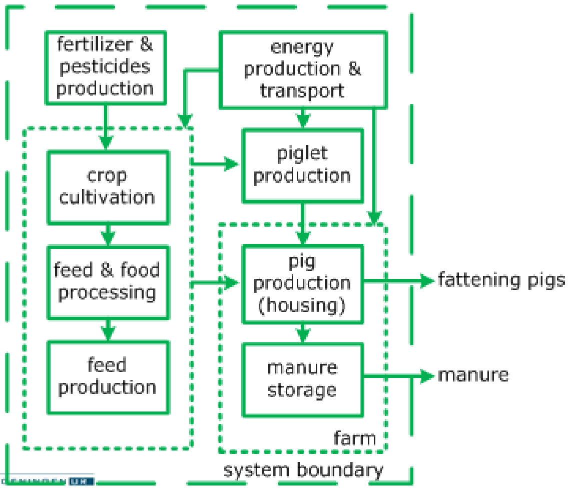
- Economic performance
  - Net farm income (Euro / AWU)
  - Labour productivity (hours / 100 kg slaughter weight)

- Societal performance
  - Use of antibiotics (DDAY)
  - Mortality rate (# / 100 kg SW)

Material & Method (environmental)

- Environmental performance
  - Life Cycle Assessment
    - Cradle to farm gate
    - Functional unit: 100 kg slaughter weight
  - Impact
    - Land occupation
    - Non-renewable energy use
    - Climate change
    - Eutrophication
    - Acidification

System & system boundary



Material & Method (best practice)

Step 1 • Determine objective function per indicator

Step 2 • Normalize the scores

Step 3 • Determine best performing group

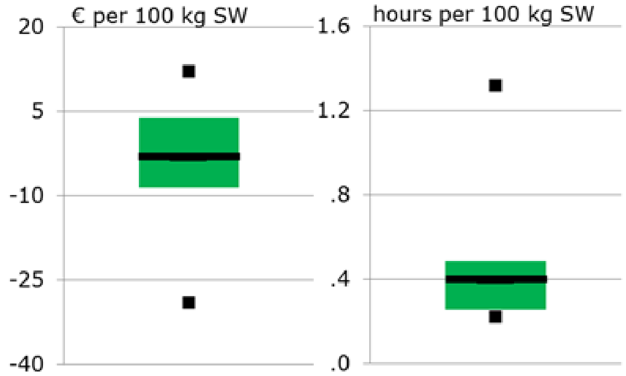
Step 4 • Compare groups

Step 5 • Benchmark

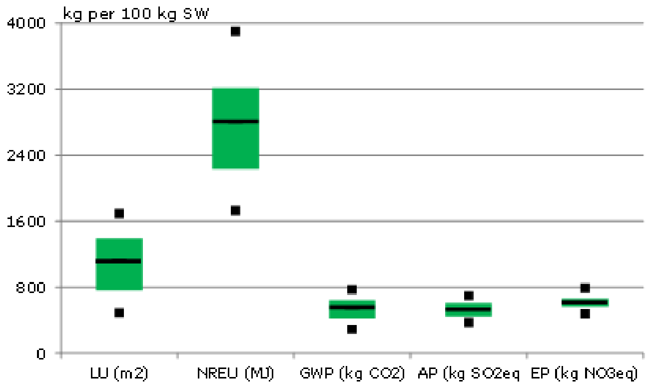
Results (descriptive)

Farm characteristic	unit[a]	mean	st.dev
Average no. fattening pigs	number	2,712	2,075
Traditional animal places	number	2,050	1,941
Low-emission animal places	number	1,164	1,608
Labor	awu	1.3	1.0
Average piglet weight	kg / piglet	23.9	1.8
Average slaughter weight	kg / fattening pig	92.4	2.1
Slaughter weight delivered	kg / year	730,225	551,187
Dry feed intake	kg DM / 100 kg SW	210.6	48.3
Other feed intake	kg DM / 100 kg SW	39.6	46.7
Gross N excretion	kg N / 100 SW	4.6	0.8
P excretion	kg P / 100 SW	0.8	0.2

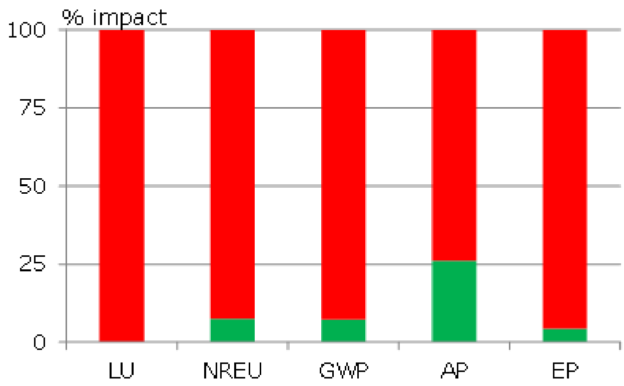
Results (economic)



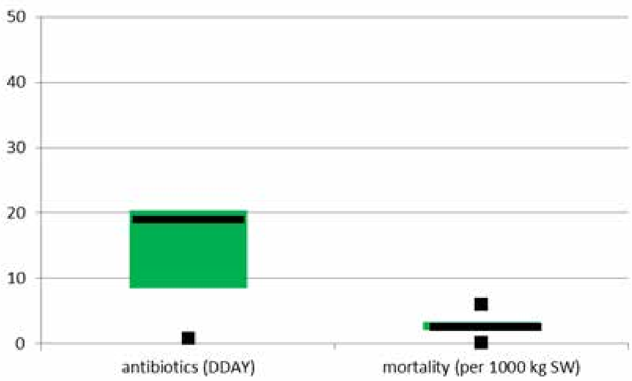
Results (environmental)



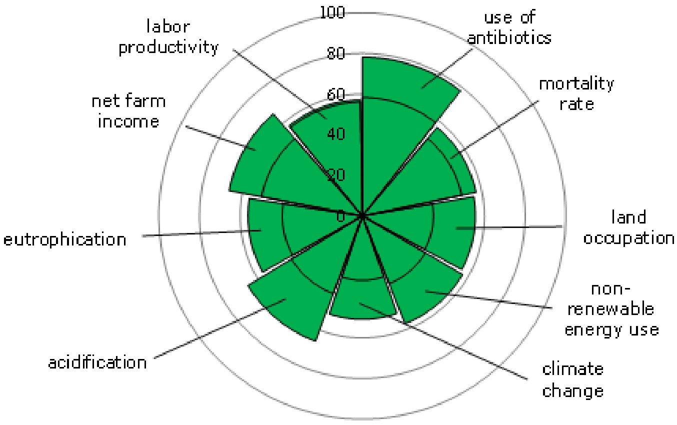
Results (environmental)



Results (societal)



Results (best practice)



Results (best practice)

Farm characteristic	unit[a)]	average	best performing	α[a)]
Average no. fattening pigs	number	2,712	4,087	**
Share of low emission a. places	%	36	28	ns
Labor	awu	1.3	2.0	**
Share of unpaid labor	%	76	63	*
Level of education	0-10 scale	5.3	5.3	ns
Farmers age	year	52.2	51.8	ns
Average piglet weight	kg / piglet	23.9	23.1	ns
Average slaughter weight	kg / fattening pig	92.4	93.3	ns
Slaughter weight delivered	kg / year	730,225	1,092,871	**
Share of other feed intake	%	10	23	**
Feed intake	kg DM / 100 kg SW	250	248	ns
Feed intake adjusted	kg DM / 100 kg SW	235	229	*

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Discussion

- Differences in variation:
  - High variation in economic performance
- Choice of indicator:
  - Societal require animal based indicators
  - Some sustainability aspects can not be quantified at farm gate
- Best performing farm:
  - Subjective method
  - What about the farmer?

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Conclusion

- FADN gives insight in variation in 3P performance
- Feed is important, it highly affects the environmental impact and influence the farmers income
- We need better societal indicators
- The ‘farmer’ needs to be quantified...

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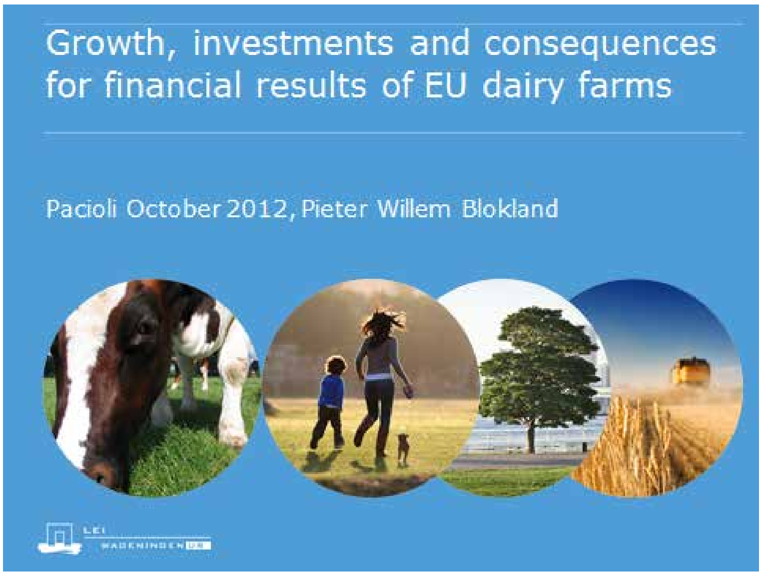
14 Investments in dairy farming

Pieter Willem Blokland



Aim of the study

- Dutch Dairy Board
- The aim of the study is to gain understanding in the relation between investments and financial results of dairy farms
- Focus is on Dutch dairy farms
- Why are the best the best?

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Investments of Dutch dairy farms (2001-2009)

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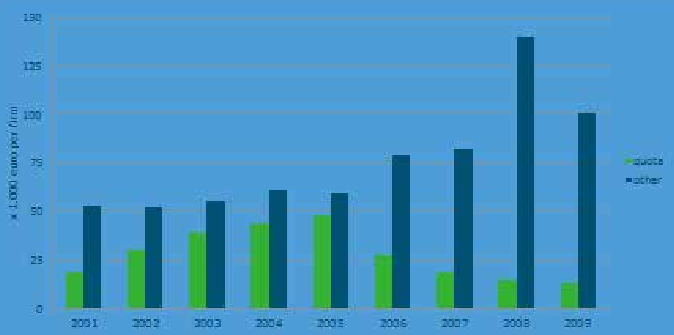
Investments of Dutch dairy farms (2001-2009)



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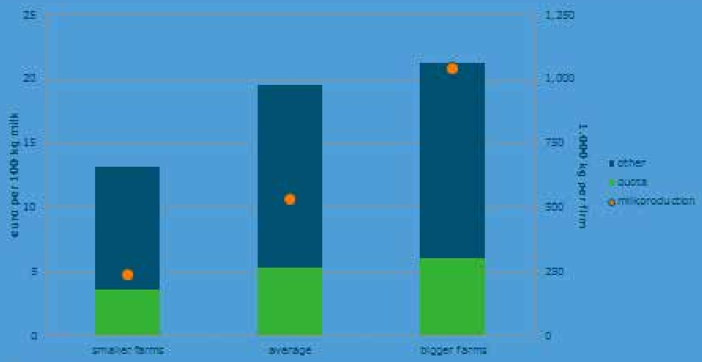
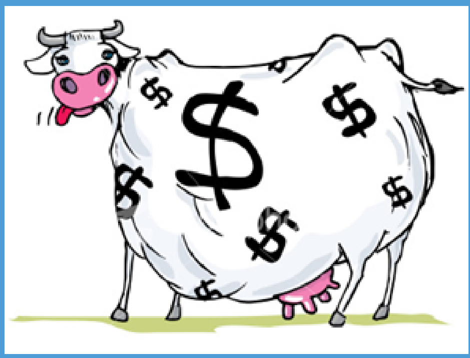
Investments of Dutch dairy farms (2001-2009)



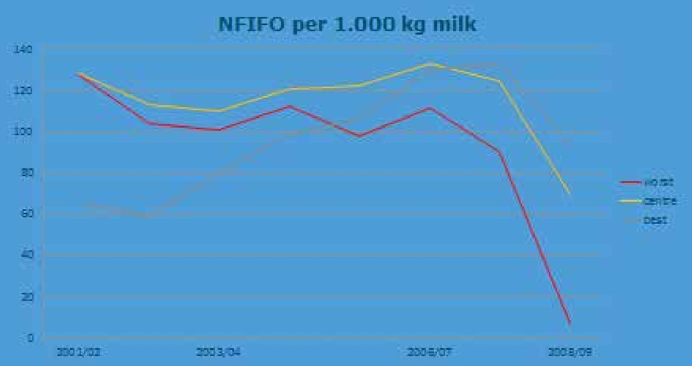
Farm income of growing Dutch dairy farms



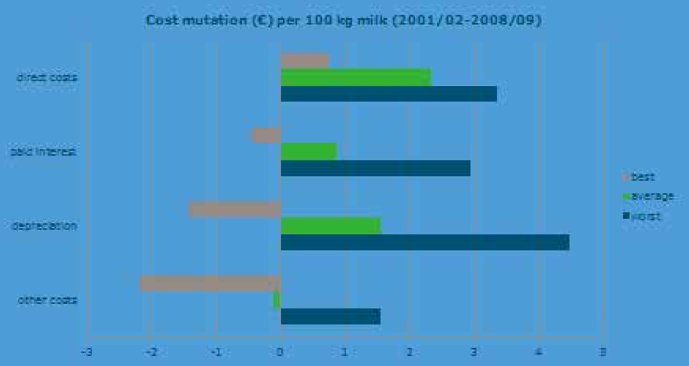
Farm income of growing Dutch dairy farms

- Relation between growth and financial results
- Focus on growth in milk production
- Selection of farms
  - Farms with minimal 500.000 kg milk production
  - Minimal 25% growth in milk production since 2001
  - Maximum 30% quota investments of total quota investments in last 2 years
  - Selection of 48 dairy farms
  - Three groups: 25% worst, 50% centre and 25% best farms (based on income)

Farm income of growing Dutch dairy farms



Farm income of growing Dutch dairy farms



Farm income of growing Dutch dairy farms

	worst group			best group		
	2001/02	2008/09	mutation	2001/02	2008/09	mutation
milk production (1.000 kg)	497	787	+291	526	817	+292
Long term loans (1.000 €)	419	1.263	+844	431	920	+490
Results (€ per 100 kg milk)						
Revenues	42,25	41,75	-0,50	42,75	43,05	+ 0,30
milk	34,45	31,65	-2,85	34,25	31,70	-2,60
Costs	28,80	41,15	+ 12,3	37,15	33,85	-3,30
direct costs	10,45	13,85	+ 3,40	12,50	13,20	+ 0,70
paid interest	3,95	6,90	+ 2,90	4,80	4,35	-0,45
depreciation	4,50	9,00	+ 4,50	7,00	5,60	-1,40
other costs	9,90	11,45	+ 1,60	12,85	10,70	-2,20
Farm income from operations	13,45	0,60	-12,85	5,60	9,20	+ 3,60

Farm income of growing Dutch dairy farms

- No specific reason why the best are the best
  - Debt capital has influence on income (interest and depreciation)
  - Age, farm size and production intensity do not show a relation with the financial results
- Capability and qualities of the farmer play a crucial role in the financial results
- Modernity of durable goods is important

Characteristics of growing dairy farms in the EU

- Selection of EU farms based on FADN data
  - Minimal 200.000 kg milk production
  - 20% growth in milk production between 2001-2007
  - Growth in milk production in last 2 years lower than 25% of total growth in 2001-2007
  - Only specialised dairy farms
- Focus on cash flow instead of income
  - Differences in depreciation methods between countries
- Netherlands, Germany, France, UK and Ireland

Characteristics of growing dairy farms in the EU

Characteristics of strong growers	NL	D	F	GB	IRL
Milk production and investments					
Milk production 2007 (x1000 kg)	791	523	448	809	394
Growth since 2001 (%)	53	47	52	57	46
Investments per 100 kg growth 2000-2007 (€)	342	171	243	151	142
• quota (%)	50	0	2	10	20
• land (%)	8	7	3	6	2
• buildings (%)	24	36	43	36	39
• machines/installations (%)	18	56	51	47	35
• other (%)	1	1	2	1	4

Characteristics of growing dairy farms in the EU

Income and cash flow per 100 kg milk 2004-2007	NL	D	F	GB	IRL
Subsidies	3,4	7,3	9,0	3,7	7,1
Revenues	40,1	43,5	48,8	33,9	37,6
- milk revenues	*32,3*	*32,1*	*30,1*	*27,9*	*28,2*
Depreciation	4,8	6,4	9,7	4,8	4,8
Paid interest/labour/rent	6,7	4,6	6,2	3,5	3,8
Other costs	8,9	11,0	14,0	5,6	6,0
Direct costs	11,8	15,3	16,9	14,3	13,5
Farm income from operations	11,3	13,4	11,0	9,4	16,6
Cash flow	16,1	19,8	20,7	14,2	21,4
Growth with regard to period 2000-2003 (%)	*14*	*11*	*4*	*8*	*11*

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Characteristics of growing dairy farms in the EU

- Differences between successful and unsuccessful growers based on cash flow (€/100 kg milk)

	Unsuccessful growers			Successful growers		
	Cash flow 00-03	Cash flow 04-07	Difference	Cash flow 00-03	Cash flow 04-07	Difference
Netherlands	15,7	15,0	-0,7	12,7	17,0	4,3
Germany	18,4	18,2	-0,2	17,1	21,7	4,7
France	21,3	17,7	-3,6	19,0	23,2	4,2
United Kingdom	14,2	13,1	-1,1	12,3	15,2	2,9
Ireland	19,4	18,6	-0,9	19,1	24,3	5,2

Characteristics of growing dairy farms in the EU

- Investments per kg growth (€)

	Unsuccessful growers (a)	Successful growers (b)	b in % of a
Netherlands	3,6	3,3	93
Germany	1,6	1,9	119
France	2,3	2,6	114
United Kingdom	1,4	1,6	119
Ireland	1,4	1,4	98

Characteristics of growing dairy farms in the EU

- Investments per kg growth (€)

	Unsuccessful growers (a)	Successful growers (b)	b in % of a
Netherlands	3,6	3,3	93
Germany	1,6	1,9	119
France	2,3	2,6	114
United Kingdom	1,4	1,6	119
Ireland	1,4	1,4	98

Financial results are dependent of:

- Capabilities and qualities of farmers
- Modernity of durable goods
- Differences between countries in investing behaviour

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15 Machinery and equipment in Italian agriculture

Concetta Cardillo

15.1 Introduction

Over the centuries, agricultural sector has undergone profound changes, but it was only with the invention of the combustion engine in the late nineteenth century, the foundations were laid for the mechanization of agriculture. At the beginning of the twentieth century it was used for the first time the word 'tractor'.

The invention of the new combustion engine has made possible the intensification of crops which has become to meet the dietary needs of a growing world population.

It follows that the mechanization of agriculture has affected and transformed over the years, the technical and economic efficiency of farms. In particular, farmers, given the nature of land, organization and management of their farms prefer buying a machine rather than resorting to the work performed by third parties and/or a more use of workforce.

Given the importance and the development of mechanization in Italian agriculture the goal of this work is to investigate this phenomenon through the use of the data of the Farm Accountancy Data Network (FADN). In particular, since, the database FADN has never been used to analyze agricultural mechanization, we want to verify both, the possibility to use the information contained in the database FADN for the analysis of the mechanization of Italian agriculture, and the definition of a methodology for analyzing the characterization of the mechanization of agriculture through the Italian FADN.

15.2 The methodology and the database

To analyze the various aspects that characterize the level of mechanization of Italian farms were used information contained in the FADN data for the accounting year 2010, that for each machine and registered tool, makes available a variety of information on technical and economic. Moreover, the FADN is the only harmonized source at European level of microeconomic data on the business operation and the economic and structural dynamics of farms operating in the agricultural sector.

Among the farms that take part in the FADN sample (11,156 farms), for the analysis have been considered only those that have agricultural machinery and UAA greater than zero hectares. In addition, they were considered only those groups that included at least 5 observations (farms). Were thus identified 11,025 farms on which the analysis of mechanization was performed.

Among the various information contained in the database FADN those considered for the analysis performed were (Table 1): the number of farms, the Utilized Agricultural Area (UAA), the economic size, the crops, the number of machinery for farm, the value of machinery, the farm net income, the farm capital, the power of machines, etc.

Table 1 Variables utilized for the analysis

Number of Farms	Number of machinery per farm
Type of crops	Value of machinery (€)
Economic size	Costs of gasoline per farm (€)
Utilized Agricultural Area (ha)	Age of machinery
Farm Net income (€)	Power of machines (HP)
Farm capital (€)	Utilized machinery per crops (hours/ha)

For machines were considered the categories related to tractors and self-propelled (Table 2). The category of the tractors contains, 4 different types of machines, while that of self-propelled operating contains 18 different types.

Table 2 Machines and tools

Machines		Tools
Tractors	Operator self-propelled	Groups of activities
crawler	Self-propelled atomizer	tillage
with isodiametric wheels	harvester	sowing/transplant
with 2 wheels drive	cultivator	fertilization
with 4 wheels drive	forklift	irrigation
	combine self-leveling	phytosanitary treatments
	… … …	pruning
	Other operator self-propelled	harvesting
		……….

The tools, however, have been grouped into nine homogeneous types: equipment for tillage, sowing equipment and transplantation, equipment for fertilizing, irrigation equipment, equipment for treatments, equipment for support/protection, equipment for pruning and collection of tree crops, equipment for the collection of herbaceous crops, and, finally, equipment of transport. Subsequently, farms were grouped according to types of farming (arable crops, horticulture, permanent crops, herbivores, granivores, polyculture, Mixed livestock, mixed crops and breeding) and classes of economic size.

The economic size classes have been redefined and, therefore, were not used size classes provided by the FADN. In particular, have been defined 4 groups:

- From 4.000 € to less than 8.000 euro;
- From 8.000 € to less than 16.000 euro;
- From 16.000 € to less than 50,000 euro;
- More than 50,000 euro.

For each group thus identified were defined Machinery and equipment. For the latter, it has been calculated, then, the average value.

The analysis of the FADN information on the economic value of agricultural tools and machines required the use of a procedure that would allow the identification of observations considered 'abnormal' for the purposes of work. Therefore, it has been carried out a preliminary analysis of the data for identifying the shape of the distribution of the subpopulations of the sample according to the criterion of post-stratification adopted for the analysis (pole and Economic size class). This allowed us to adopt the 'best' procedure for the identification of outliers. In fact, outliers can affect many indicators. In our case, the average value is an indicator sensitive to extreme values of the distribution, and will be conditioned by them, thus being a not effective synthesis of observations.

After verifying the asymmetry in subpopulations of the sample, using either the graphical analysis of box-plot that the asymmetry index of Skewness, an index which provides a measure of its lack of symmetry, it was decided to use a procedure based on median, which is an index of synthesis less influenced by the presence of the average of these values.

The procedure for identifying data 'abnormal' (outliers) has been set on the variable replacement value of machinery and equipment using the 'Diagrams Box and Whisker Plot', presented for the first time in Tukey in 1977. The graph is built considering the three quartiles of the distribution: Q_1 (first quartile), Q_2 (median), and Q_3 (third quartile) and the values of maximum and minimum. Is also considered the interquartile range ($IQR = Q_3 - Q_1$) to determine the threshold values of the distribution of FADN:

- The Lower Adjacent value (LAV), defined as the smallest observed value (minimum) that is greater than or equal to:

$$LAV = Q_1 - 1,5 \times (IQR)$$

- The Upper Adjacent Value (UAV) defined as the largest observed value (maximum) that is less than or equal to:

$$UAV = Q_3 + 1,5 \times (IQR)$$

The interval of 1,5 has been proposed by Tukey without special properties. In fact, it is his choice based on his statistics 'common sense'.

If the two extreme values are contained within the interval between LAV and UAV in the data collected there are no outliers. After the identification of outliers, these were replaced with the minimum or maximum value of the distribution of values without outliers (values in the range of LAV - UAV) depending on the outlier itself was less than the LAV or greater than the UAV.

Once the FADN database has been identified and corrected from the outliers we proceeded to the definition and calculation of a set of structural and economic indicators to measure and characterize the mechanization of Italian agriculture.

15.3 Results

The technical and economic analysis of the mechanization of Italian farms, as already said, was achieved through the construction of various structural and economic indicators.

In our case the structural indicators built and adopted are aimed at both defining the technical and structural characteristics of the mechanization, and the identification of the degree and / or level of intensification of the same in the different farms.

In particular, the structural indices used are as follows:

- Economic size: shows for each cultural group identified the classes of economic size into which have been divided different farms;
- Number of farms: expresses the number of farms in the different groups;
- Average Utilized Agricultural Area (UAA): expressed in hectares. Indicates the average UAA of farms in the different groups;
- Value of machines per farm: Indicates the value of the machine for each group. It is expressed in euro;
- Value of machines/Farm capital: it expresses the percentage of the value of the machines on the corporate capital;
- Farm net income per hectare: represents the net farm income per hectare. It is expressed in euro;
- Value of machines per hectare: it expresses the value of machinery per hectare. Although this index is expressed in euro;
- Power of machines per hectare: indicates the power of the machines used per hectare. It is expressed in horsepower per hectare;
- Cost of gasoline per farm: represents the cost that the farmers face up for the purchase of fuel. It is expressed in euro.

The following table presents the results of the calculation of structural indices only for crops. The analysis allows us to state that most of the farms used mechanical means of properties to perform various farming operations.

Table 3 Machines - Structural indexes for 'arable land'

Type of Crops	Arable land			
Economic Size (€)	**4,000-8,000**	**8,000-16,000**	**16,000-50,000**	**more than 50,000**
Number of Farms	292	501	957	1,152
Average UAA (ha)	8,4	12.6	25.1	80.6
Value of Machines per farm (€)	37,782	48,973	77,888	185,423
Value of Machines/ Farm capital (%)	26.5	19.2	19.9	15.6
Farm Net Income per hectare	591	717	691	1,036
Value of Machines per hectare	4,498	3,875	3,103	2,301
Power of machines (HP) per hectare	11	9	7.3	4.9
Cost of Gasoline per farm (€)	952	1,550	2,925	10,793

Furthermore, the analysis of the table shows a particular trend in some of the indexes analyzed. In particular, some indexes, as it was obvious to expect, they grow in value with increasing size class of enterprises, but in the case of the value of machines per hectare, the power of machines per hectare and the Value of machines / Farm capital seems that the situation is opposite. That is, the value of these indices decreases with the increase of economic size of the farms. This would seem to be due to an over-sizing of the gear of machines as well as to their 'bad' use.

Instead, economic indices calculated for each group (identified for crops group and for economic dimension) and differentiated according to the type of machines that are used in the analysis are:

- Numbers of machines for farm: is the number of different types of machines in each group identified;
- Value of machines: expresses the average value of the machines for group. This index is expressed in euro;
- Power of machines: indicates the average power of the machines in the various farms groups. It is expressed in horsepower;
- Age of machines: is the average age of machines on farms. It is expressed in years.

Table 4 shows the values of economic indicators in the case of tractors. Analysis of the table shows how in several cases we have no information. This is due to the fact that several groups have less than five observations and, therefore, it has been not possible to proceed to the calculation of the relative indices.

Table 4 Machines - Economic indexes for 'tractors'

Type of Crops	**Arable land**															
Economic Size (€)	**4,000-8,000**				**8,000-16,000**				**16,000-50,000**				**more than 50,000**			
	N	**Average per machine**			**N**	**Average per machine**			**N**	**Average per machine**			**N**	**Average per machine**		
		A	**P**	**V**		**A**	**P**	**V**		**A**	**P**	**V**		**A**	**P**	**V**
Crawler	56	23	63	21,627	114	21	70	25,340	289	20	76	27,208	355	19	89	34,194
Isodiametric wheels									1				1			
2 wheels drive	169	20	60	26,600	295	22	63	26,062	617	21	65	26,208	1,240	19	74	29,416
4 wheels drive	124	19	80	33,099	334	18	81	33,945	967	16	93	38,147	2,429	14	106	44,173

Legend: **N** = number of machines per farm; **A** = Age of machines (years); **P** = Power of machines (HP); **V** = Value of machines (€)

Furthermore, the other information that emerges from the table is, in general, the high age of agricultural machinery and, as already said before, the little difference that exists between the different groups, both as regards the power and for the value of agricultural machinery.

In Table 5, however, are presented the results of the economic indicators related to self-propelled machines. Even in this case the farms have been divided into groups identified on the basis of the type of crops and the class of economic size.

Table 5 Machines - Economic indexes for 'operating self-propelled'

Type of Crops	**Arable land**															
Economic Size (€)	**4,000-8,000**				**8,000-16,000**				**16,000-50,000**				**more than 50,000**			
	N	**Average per machine**			**N**	**Average per machine**			**N**	**Average per machine**			**N**	**Average per machine**		
		A	**P**	**V**		**A**	**P**	**V**		**A**	**P**	**V**		**A**	**P**	**V**
Atomizzatore semovente					2				5	21	23	6,670	8	11	64	13,063
Carrello elevatore	1				1				8	19	34	6,581	23	12	45	12,183
Mietitrebbiatrice autolivellante	4				15	21	125	80,039	87	20	164	98,324	295	15	185	113,536
Motocoltivatori	67	20	15	4,613	80	20	16	5,175	163	18	15	4,482	203	16	17	5,203
Motofalciatrice	21	28	14	2,838	38	27	13	4,039	97	27	15	3,898	120	27	13	2,954
Motoranghina-tore					3	35	13	3,500	5	27	21	4,700	10	20	16	4,655
Motozappatrice	22	18	11	2,507	40	15	13	2,578	90	17	11	2,561	59	17	13	2,758
Piattaforma semovente													5	15	24	11,800
Raccoglitrice generica	2				1				10	12	29	8,745	35	10	73	43,745
Scuotitore semovente									1				1			
Altre macchine operatrici semoventi	22	15	35	15,686	19	18	36	16,427	58	15	51	23,426	152	12	65	43,442
Spandimangime semovente					1								5	12	48	22,800

Legend: **N** = number of machines per farm; **A** = Age of machines (years); **P** = Power of machines (HP); **V** = Value of machines (€)

The structural indices were calculated also for self-propelled machinery but, with the exception of some index such as the cost of gasoline per farm, are substantially similar to those calculated for the machines. So, in this paper, they have not been examined.

Furthermore, for self-propelled machinery we can apply the same considerations as in the case of tractors. Even in this case there are several missing information, because there are several groups that have a number of observations less than 5. In general, it can be said that the self-propelled machines are old on average and, for those types present in the 4 groups identified on the basis of economic size the analysis shows a value of the same almost equal. This confirms, once again, as the Italian agriculture is characterized by the presence of an oversize of the rolling stock. This is particularly true especially in the case of groups with an economic size small.

Table 6 Tools - Economic indexes for 'permanent crops'

Type of Crops		Permanent Crops		
Operations	**Tools**	**Tools per farm**	**Age (years)**	**Value (€)**
Fertilization	Spandiconcime	1.334	15	1.682
	Spandiletame	133	20	4.884
	Spandiliquame	31	26	5.401
Tillage	Aratri	1.846	20	2.649
	Erpici	1.934	18	2.324
	Fresatrice	1.333	16	2.869
	Sarchiatrice	103	18	2.992
	Vangatrice/Zappatrice	406	17	3.159
Pruning	Braccio scuotitore	166	9	8.584
	Cimatrice-spollonatrice	377	9	4.218
	Forbici pneumatiche	356	8	1.191
	Trinciasarmenti	979	12	3.176
Harvesting field crops	Barra falciante	239	15	2.202
	Falciatrici	215	14	3.094
	Imballatrice	58	24	5.041
	Ranghinatore-voltafieno	182	20	1.844
	Rotoimballatrice	64	14	10.230
	Varie raccolta colture erbacee	152	17	5.872
Sowing/transplant	Seminatrice a righe	317	20	3.394
	Seminatrice a spaglio	58	18	2.782
	Seminatrice di precisione	101	17	6.290
	Trapiantatrici	6	11	10.053
Phytosanitary treatment	Atomizzatore portato	779	13	3.865
	Atomizzatore trainato	1.520	13	5.501
	Barra per diserbo	274	15	2.120
	Varie attrezz. Trattamenti	1.002	14	2.419

Subsequently, we have determined the economic indicators for the tools (Table 6).

Before proceeding to the calculation of economic indicators, tools have been grouped according to the type of operation carried out (fertilization, tillage, pruning, harvesting field crops, etc.) and divided between different cultural groups.

The economic indicators used for tools were: the average number per farm, the average age of each tool, and finally, their economic value.

In this case, what is clear from the start is the fact that all types of tools are enhanced. In particular, we note the presence of a high number of gears for the groups related to the fertilization and soil tillage. Once again, also in this case the average age of equipment particularly high.

After the economic indices it has been calculated the number of hours of work (employment) of machines per hectare, divided by type of crops for the 4 groups identified (Table 7).

Table 7 **Machines - Working hours per group of crops and per hectare**

	ECONOMIC SIZE (€)											
TYPE OF CROPS	4,000-8,000			8,000-16,000			16,000-50,000			more than 50,000		
	Machi-nes	UAA	Hours/ha	Machi-nes	UAA	Hours/ha	Machi-nes	UAA	Hours/ha	Machi-nes	UAA	Hours/ha
Field Crops	227	754	41,27	518	2,293	24.11	1,356	10,577	20.19	2,222	41,929	22.35
Oil Seeds	10	50	31,18	23	109	16.06	80	582	25.42	179	2,869	26.08
Horti-colture	55	21	223.47	176	80	285.50	479	386	168.41	1,144	5,137	88.58
Fodder	118	510	40.53	305	2,048	20.23	818	9,448	14.40	1,535	36,890	14.08
Permanent Crops	50	40	96.43	97	97	140.12	430	804	137.40	641	3,586	100.50
Vineyards / Olives	177	240	93.27	361	689	72.39	937	2,455	67.44	1,275	11,909	76.58

The analysis of the table shows that the smaller size classes show higher values than all the others. This is probably due to the adoption of a cultural technique not efficient and to a not efficient scheduling of work.

Horticulture is the group of crops which accounts the high value, but it was natural to expect these results if we consider the type and the characteristics of this crop.

Finally, to complete the work proposed it was made a comparison between the Italian and the agricultural mechanization in other EU countries (Tables 8a - 8b).

The comparison is made using the average value of the machines in the different EU countries divided among the various type of crops.

Table 8a **Mechanization of Italian agriculture versus mechanization of European Union for the specialized type of farming**

Country	Field Crops	Horticulture	Permanent Crops	Grazing live-stock	Granivore
Austria	1,358		3,528	2,143	2,552
Belgium	1,254	10,836	5,858	1,097	2,339
Bulgaria	321	2,155	1,389	178	5,020
Cyprus	931		3,317	1,834	
Czech Republic	807	13,929	2,144	570	11,349
Denmark	1,573	8,747	2,912	2,411	3,473
Estonia	446	751	150	431	2,433
Finland	1,049	16,841		1,576	2,419
France	756	5,433	1,673	657	1,747
Germany	703	9,243	3,418	1,160	1,724
Greece	1,611	5,028	2,295	1,164	1,440
Hungary	503	2,134	1,068	381	995
Ireland	895			603	
Italy	1,291	6,564	2,461	1,010	2,306
Latvia	398		389	268	5,004
Lithuania	706	2,573	970	808	
Luxembourg			6,830	2,066	
Malta		9,239	6,722	15,513	59,760
Netherlands	2,630	56,497	10,492	2,758	10,257
Poland	953	5,639	2,442	1,186	1,537
Portugal	669	3,913	902	282	930
Romania	402	3,639	1,251	579	4,961
Slovakia	316			231	
Slovenia	3,074		2,935	2,144	
Spain	226	1,318	466	251	755
Sweden	810	2,248		962	967
United Kingdom	747	4,889	2,693	415	2,578

Source: European Commission

The analysis of the values of the machines in the EU shows that agricultural mechanization in Italy is similar to the mechanization present in the other EU countries. However, if you make a comparison between Italy and Spain, with Greece and, in part, with France, as countries that are similar to the Italian agriculture it can be seen as the farms in Italy have a gear slightly higher than in other countries.

Table 8b **Mechanization of Italian agriculture versus mechanization of European Union for the mixed type of farming**

Country	Mixed Cropping	Mixed Livestock	Mixed Crops-Livestock
Austria	1,768	2,290	1,883
Belgium	1,843	1,569	1,279
Bulgaria	461		568
Cyprus	1,405		
Czech Republic	958	799	806
Denmark	1,569	2,586	1,927
Estonia			493
Finland			1,377
France	854	946	773
Germany	929	1,260	884
Greece	1,766	1,327	1,404
Hungary	572	673	440
Ireland			1,090
Italy	1,666	1,560	1,543
Latvia	230	243	256
Lithuania	846	889	691
Luxembourg		2,911	2,124
Malta	4,906		
Netherlands	2,279	3,540	2,416
Poland	817	925	838
Portugal	696	285	265
Romania	429	466	478
Slovakia	293		329
Slovenia	2,155	2,019	2,063
Spain	259	198	182
Sweden			956
United Kingdom	739	728	636

Source: European Commission

Before completing the examination of the results obtained in this work, we must make some considerations on FADN data. That is, the FADN database is represented by a random sample of farms that is based on a sampling design stratified by region, type of farming and classes of Economic size. To each unit collected (farm) is assigned a coefficient for the calculation of the estimates of the variables in the domain of strategic estimate planned, for the FADN they have been defined at regional and national level. The weight indicates the number of units of the population that this sampling unit represent and, therefore, allows the extension to the reference universe of information related to strategic variables (or those related to them) with a certain reliability level fixed at design time of the sample design.

However, in this work it was not possible to use the coefficients to extend the results of the analysis to the Universe of reference. In fact, the statistical unit is represented by machinery and agricultural equipment of the farms and not by the farms for which the weights are determined. So, the only measure of 'reliability' of the estimated average is given by the sample size. Precisely for this reason it was chosen to show only the results for sets with a number of observations greater than or equal to 5.

15.4 Some conclusions

The study developed showed that the FADN database contains a great number of information, with a high level of quality, which allow the characterization of both technical - structural and economic mechanization of Italian agriculture. Moreover, it seems that the method of analysis adopted corresponds to the objectives that we had set in this work. Thus, it can safely be proposed for further in-depth analysis on agricultural mechanization.

The analysis of agricultural mechanization and agricultural tools in the holdings has highlighted as Italian farms are characterized by the presence of a large number of machines, both tractors and agricultural tools, which in many cases leads to an oversizing of the agricultural mechanization. This is apparent, in particular, by observing both the number of tractors and the average power used per hectare of UAA. Since the agricultural mechanization, particularly through the work of the land, often has a significant negative impact on the environment. In particular, the negative aspects of mechanization are:

- The reduction in the content of organic matter;
- The degradation of the physical and chemical fertility;
- The preparation of the land slopes to erosion;
- The alteration of the composition of weed flora.

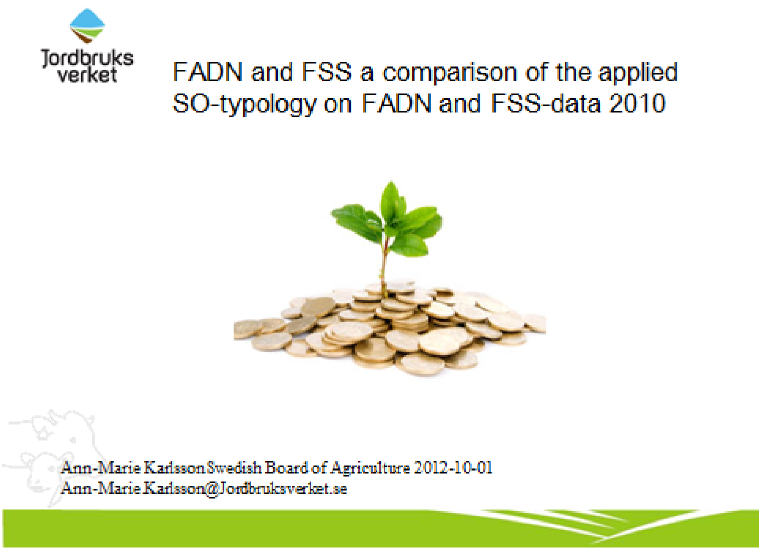
We must not also forget the role played by the mechanization on the agro biodiversity: hedges, intercropping, the traditional hydraulic - agricultural, are an obstacle to mechanization, as the tractors need space to move without any problems. It follows that, with the passage of time the mechanization induced a simplification of rural landscape elements with consequent reduction of biodiversity.

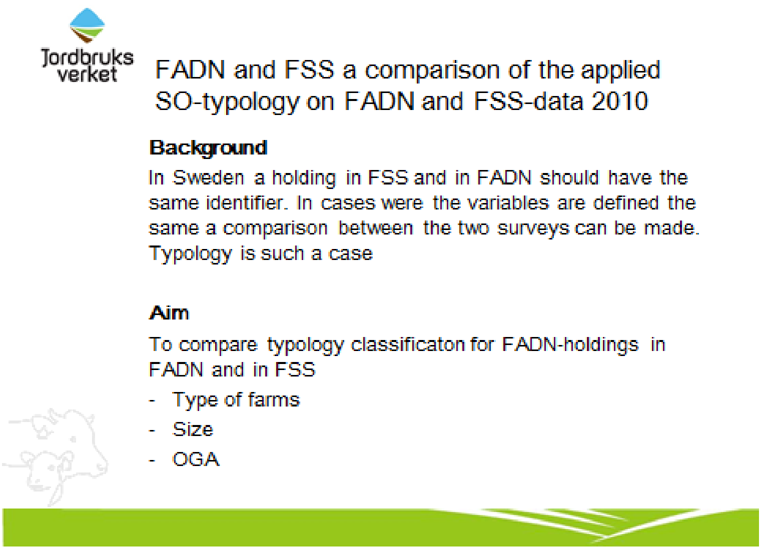
On the other hand, though mechanization has led to an increase in the productivity of agricultural labor, we must not neglect the social implications of the same.

It was therefore decided to continue the study proposed, in order to analyze both the environmental implications of agricultural mechanization, and the macroeconomic aspects of mechanization and finally, work accidents related to agricultural machines that take place in the agricultural sector.

16 Impact of diferences in applying the SO-typology on FADN-farms in FADN and in FSS for the weighting of farms

Ann Marie Karlsson





Jordbruks verket

Why differences between FADN and FSS?

- Methods for calculating and defining. For example animals are asked for in June in FSS and in FADN an average of the number of animals during the year is used.
- Different methodology for collecting data. For example OGA asked for in FSS-template and calculated based on accountancy material in FADN. Different time, different data-collectors, different staff.
- The concept of holding might differ due to how the accountancy is organized
- Mistakes

Typology according to FADN	Typology according to FSS 15	16	21	22	23	45	46	47	48	51	52	61	73	74	83	84	90	99	Total	Share	hold-ing
15 Specialist cereals, oilseeds and protein crops	86	4																3	93	8%	7
16 General field cropping	23	77		1	1	1						6			10	1		2	122	37%	45
21 Specialist horticulture indoor	1		6						2								3	6	18	67%	12
22 Specialist horticulture outdoor																			0	100%	0
23 Other horticulture																			0	100%	0
45 Specialist dairying	1	2				396	9	1							3	1		10	423	6%	27
46 Specialist cattle — rearing and fattening							184								9	1		3	197	7%	13
47 Cattle — dairying, rearing and fattening combined						1	4	1											6	83%	5
48 Sheep, goats and other grazing livestock						1	2		4							1		1	9	56%	5
51 Specialist pigs	3	2					1			92		1		3	1	12		5	120	23%	28
52 Specialist poultry											1								1	0%	0
61 Mixed cropping					1							1				1		1	4	75%	3
73 Mixed livestock, mainly grazing livestock							1						2						3	33%	1
74 Mixed livestock, mainly granivores		1					1			2			1	4		2			11	64%	7
83 Field crops — grazing livestock combined	3						3		1						27			1	35	23%	8
84 Various crops and livestock combined	2									5				1		6			14	57%	8
90																			0	100%	0
99																			0	100%	0
Total	119	86	6	1	2	399	205	2	7	99	1	8	3	8	50	23	3	32	1056		
Share missing	28%	10%	0%	100%	100%	1%	10%	50%	43%	7%	0%	88%	33%	50%	46%	76%	100%	100%			
Nr of holding not the same	33	9	0	1	2	3	21	1	3	7	0	7	1	4	23	19	3	32			

Jordbruks verket

Comparison SO value for one of the holding

FSS			FADN	
Type	151		Type	166
Size	23666			57400
B_1_1_1	22,36	Höstvete	120	2240
B_1_1_5	15,28	Råg	124	1530
B_1_12_2	12,9	träda	146 (code 3)	1294
			149	838,01
B_1_12_2			146 (code 3)	
B_1_12_1			147 (code 8)	

149 prepared for sowing leased to others (B.1.11)

Jordbruks verket

Size comparison FADN-FSS

Size	FSS													
FADN	0	2	3	4	5	6	7	8	9	10	11	12	13	Total
2			1											1
3				2										2
4				3	5									8
5	2	1		1	20	13	2							39
6	1			1	11	116	31							160
7	13				3	19	177	21	1					234
8	11			1		3	49	273	17					354
9	7		1	2			2	32	114	4	1			163
10	2						1	1	16	30	1		1	52
11							1	1	1	11	9	2		25
12							1			3	1	7		12
13												3	3	6
Total	36	1	2	10	39	151	264	328	149	48	12	12	4	1056

Jordbruks verket

The SO value in FSS compared to FADN i.e FSS value divided with FADN-value

	FSS-SO divided with FADN-SO						
	<50	50-90	90-110	110-150	>150	empty	Total
15 Specialist cereals, oilseeds and prot.	1	1	6	75	7	3	93
46 Specialist dairying		71	117	6		3	197
51 Specialist pigs	15	57	21	19	3	5	120
Totalsumma	16	129	144	100	10	11	410

Type15: Systematically higher SO in FSS compared to FADN

Types 46 and 51: Systematically lower SO in FSS compared to FADN

Other types of farming OK

Other gainfull activities

	OGA FSS					
OGA FADN	No match	0-10 %	11-50 %	51-100 %	**Total**	
0-10 %	28	680	97	26	**831**	18%
11-50 %	6	92	89	11	**198**	55%
51-100 %	2	3	15	7	**27**	74%
Total	**36**	**775**	**201**	**44**	**1056**	
		12%	56%	84%		

In FSS asked for in template

In FADN calculated based on accountancy material

Conclusion: Neither FADN or FSS approaches give relaible information on holdings were OGA are important

Conclusions

30-40 identifiers needs to be adjusted

Type of farm

- Something is wrong for types 15 and 16
- If classified as 15 or 16 seems delicate. How IACS codes are used should be examined.

Size

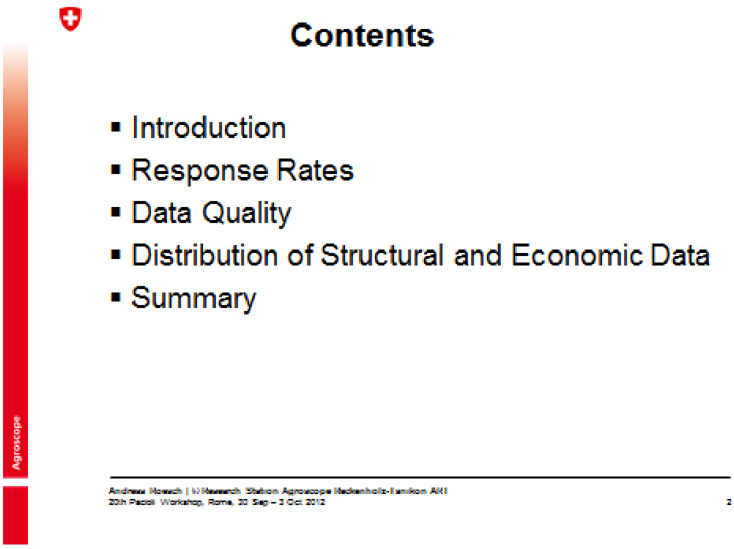
- Three type groups need further checking 15, 46, 51

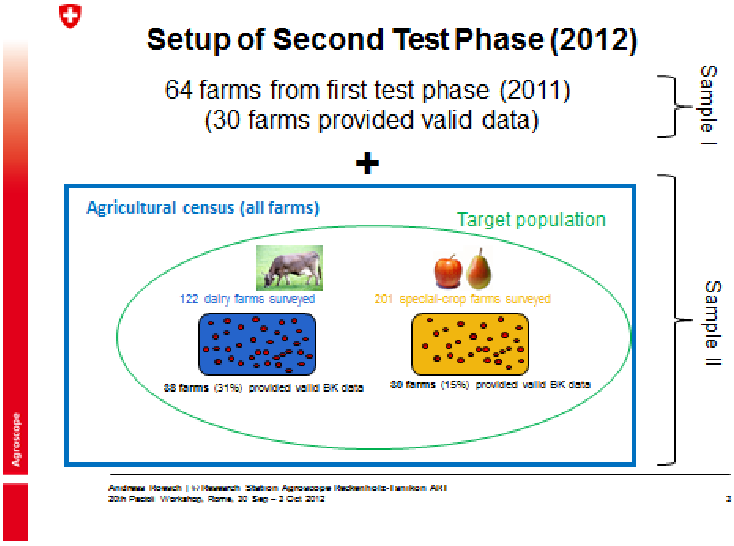
OGA

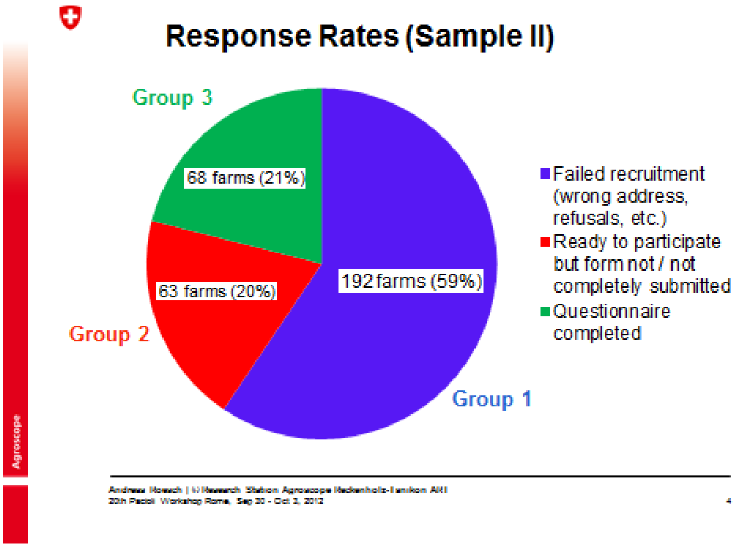
- Seem unreliable for holdings with important OGA

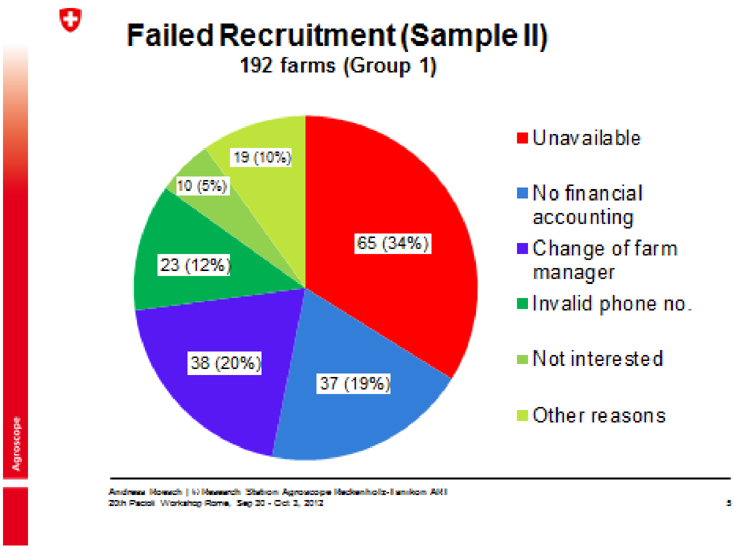
17 Random sampling - does it really improve representativity?

Andreas Roesch




Setup of Second Test Phase (2012)
64 farms from first test phase (2011)
(30 farms provided valid data)
+
Sample I
Agricultural census (all farms)
Target population
122 dairy farms surveyed
201 special-crop farms surveyed
38 farms (31%) provided valid BK data
30 farms (15%) provided valid BK data
Sample II
Agroscope


Response Rates (Sample II)
Group 3
68 farms (21%)
63 farms (20%)
192 farms (59%)
Group 2
Group 1
Failed recruitment (wrong address, refusals, etc.)
Ready to participate but form not / not completely submitted
Questionnaire completed
Agroscope


Failed Recruitment (Sample II)
192 farms (Group 1)
19 (10%)
10 (5%)
23 (12%)
65 (34%)
38 (20%)
37 (19%)
Unavailable
No financial accounting
Change of farm manager
Invalid phone no.
Not interested
Other reasons
Agroscope

Data Quality

✓ **Data quality much better than in first test phase**

owing to:

- Electronic (survey) questionnaire
- Extensive quality check
- Improved design of questionnaire
- Completion of form preferred by accountancy office
- Additional questions allow for 'harmonisation' of various bookkeeping software packages

Agroscope

Structural Characteristics

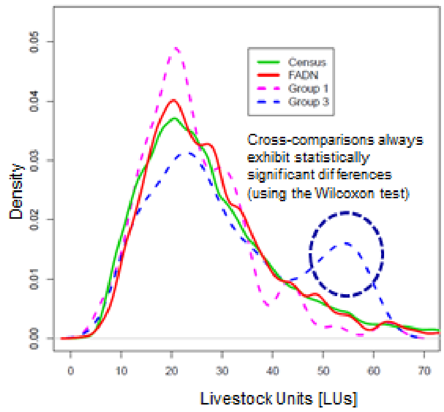
Sample II (*Census in brackets*), weighted means

	Dairying		Special Crops			
	UAA [ha]	Livestock [LU]	UAA [ha]	Fruit [a]	Vineyard [a]	Vegetables [a]
Sample II	21.8 *(21.3)*	28.9 *(28.2)*	11.8 *(12.5)*	128 *(138)*	343 *(296)*	139 *(176)*
Group 1	**19.0**	**24.4**	11.5	122	339	158
Group 3	**23.6** CV=0.63	**31.0** CV=0.49	11.7 CV=0.66	68 CV=0.25	360 CV=0.33	39 CV=0.61

Dairy farms:
Size and livestock nos. distinctly smaller in Group 1 ('Failed Recruitment') than in Group 3 ('Respondents')

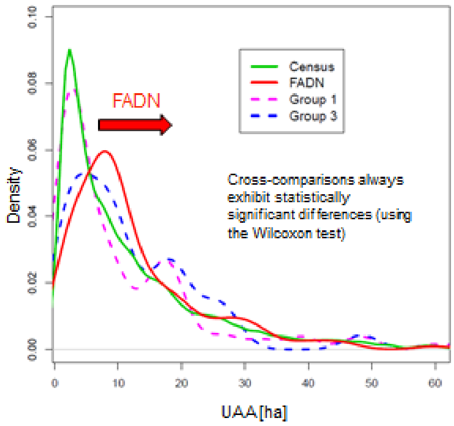
Agroscope

Dairy-Farm Livestock (Sample II)

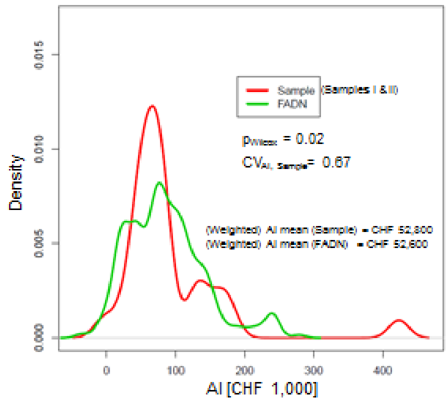


Agroscope

Size of Special-Crop Farms (Sample II)



Agricultural Income (AI), Dairying



Summary

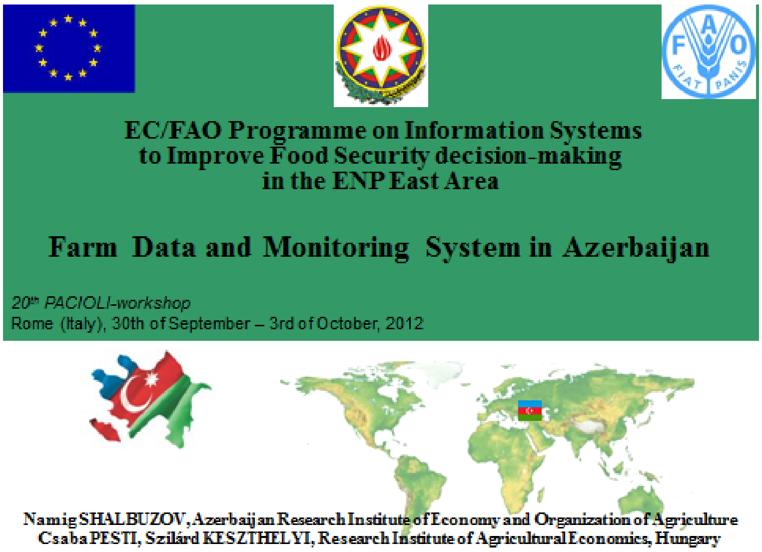
Results from the second test phase show:

- **High data quality owing to strict quality checks**
- **Low response rates (20%)**
- **Generally statistically significant differences between respondents and non-respondents (in terms of structural data)**
- **Definition of population is critical (e.g. lack of financial bookkeeping & change of farm manager)**
- **FADN data tends to be more positively biased in size and livestock nos. than census data**

→ **Promising results, but still substantial room for improvement (fully operative system for sample A is scheduled for 2015)**

18 Farm Data and Monitoring System in Azerbaijan

Namig Shalbuzov

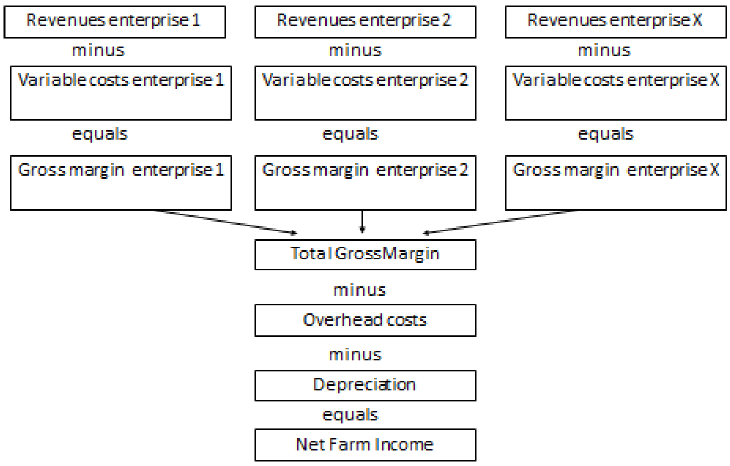


AZERBAIJAN: GENERAL INFORMATION

- **Area:** 86.6 thousand km^2
- **Population:** 9,235,000 (53%-urban; **47%-rural**)
- **GDP in 2011:** Total $62.3 billion;
  Per capita $6.8 thousand
- **GDP by sectors of economy:**
  - industry 54.6%
  - **agriculture and forestry 5.3%**
  - construction 8.1%
  - other sectors 32%
- **Distribution of employed population on types of economic activity**
  - industry 7.0%
  - **agriculture and forestry 37.9%**
  - construction 7.1%
  - other sectors 48.0%
- **Structure of agricultural products by categories of holdings**
  - Agricultural enterprises and other organizations 5.2%
  - Private owners, family peasant farms and households 94.8%

ESTRABLISHMENT OF FDMS

- **Phase 1 (2006-2009)**
- Get familiar with the issues related to the establishment of FADN;
- Development of Questionnaire and FDMS Software;
- Formation of Farm Data Unit (FDU).
- **Phase 2 (2010-1012)**
- Revised versions of farm survey questionnaire and new FDMS software;
- Sample plan (including representative sample size and distribution of sample farms by regions and type of farming categories) using agricultural census database at farm level developed;
- Managerial and organizational capacity in IEOA is developed:
  - Appointment of Deputy Director for FDMS
  - Establishment of departments for FDMS
    Department of Organization of Farm Data Collection
    Department of Information and Organization of Monitoring System
- Recruitment of out posted data collectors in 4 regions (14 data collectors)
- Concept for the establishment of country-wide FDMS in Azerbaijan developed



Source: On the basis of TCP/AZE/3001(A) Farm Business Management training manual/guidelines

Gross Margin data collection vs. Farm level data collection

Gross Margin approach:

Pro:

- Easy to understand the results on enterprise level.
- Provides direct information for the sectoral agricultural policy
- Strong statistical background is not needed.

Kontra:

- More difficult data collection
- The net farm income is difficult to calculate
- Accounting year vs. Calendar year (winter crops problem)
- Take account of fodder production (internal use)

Farm level approach:

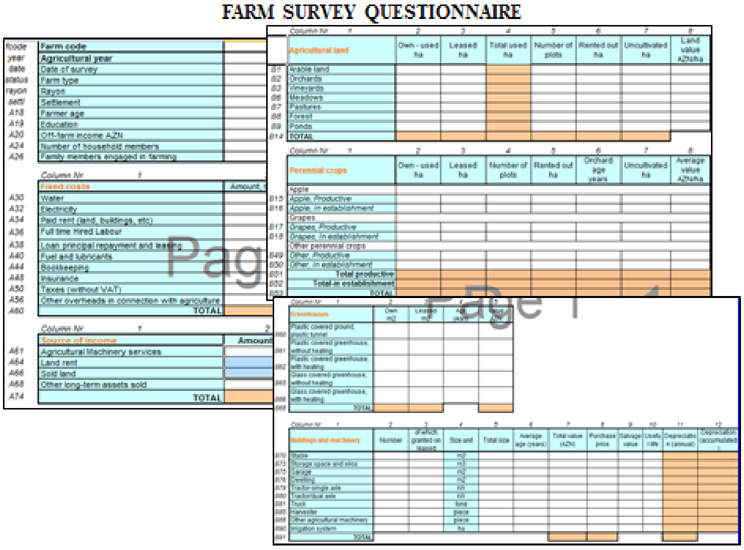
Pro:

- Clear results on farm level.
- Commonly used in Europe for policy analysis (FADN)
- Simpler data collection

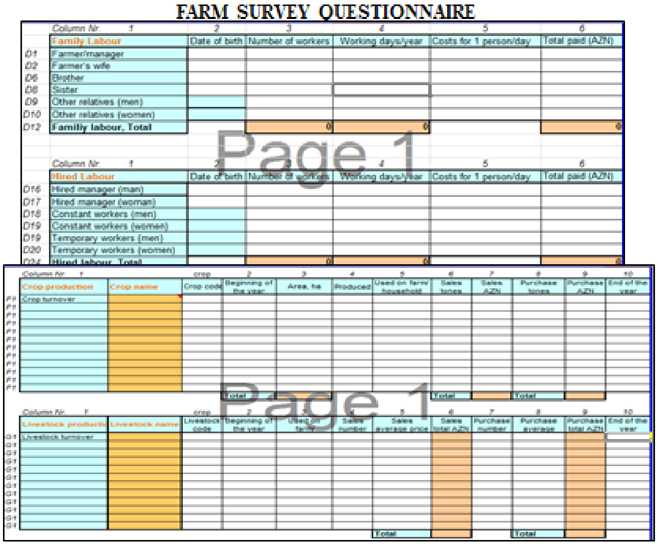
Kontra:

- Strong statistical background is indispensable (Census, farm typology, weighting scheme).
- Provides only indirect information for the sectoral agricultural policy (Farm types only)

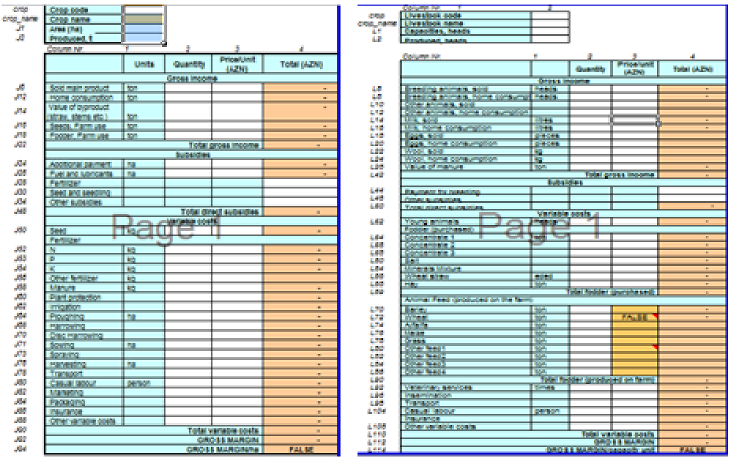
FARM SURVEY QUESTIONNAIRE



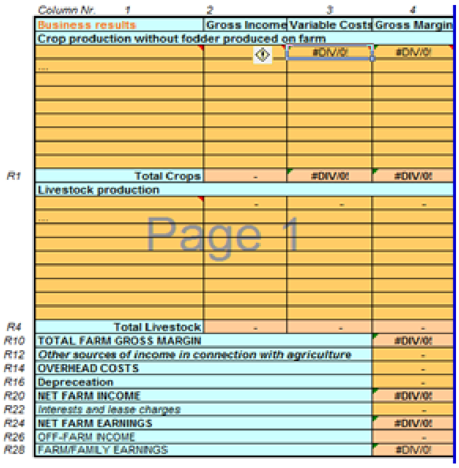
FARM SURVEY QUESTIONNAIRE



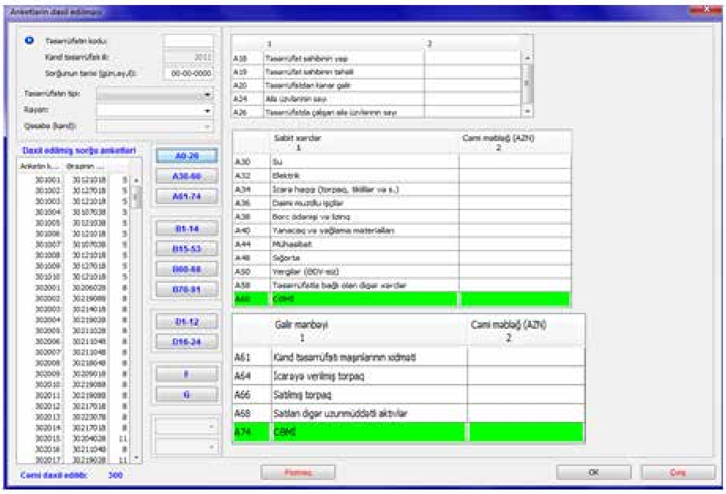
FARM SURVEY QUESTIONNAIRE



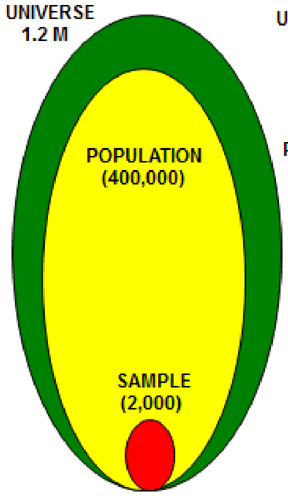
FARM SURVEY QUESTIONNAIRE



FDMS SOFTWARE



SAMPLE PLAN - Representativness: population and sample



UNIVERSE
- All farms in Azerbaijan
- 1.2 million farms in agricultural census 2005
- Most of them are subsistance farmers producing for home consumption

POPULATION
- Farms to be represented by FDMS
- Larger farm size: they produce for the market not only for home consumption
- Ca. 400,000 farms that cover 80% of area and 83% of livestock

SAMPLE
- These farms provide data to FDMS
- Need for accountancy (data collectors as advisors)
- 0.5 per cent of the population
- 2000 farms in FDMS for national coverage
- Sample size is an optimum between costs of data collection and representativeness

Farm typology results

Lower threshold	Farm number	Agricultural area ha	Agricultural area %	Livestock Unit head	Livestock Unit %
>2000 AZN SO	224 744	1 148 142	60,3%	1 839 396	61,9%
>1000 AZN SO	**419 152**	**1 511 264**	**79,4%**	**2 474 466**	**83,3%**
>500 AZN SO	588 536	1 707 668	89,7%	2 728 857	91,9%
All individual farms	**1 266 297**	**1 903 254**	**100,0%**	**2 970 521**	**100,0%**

Source: Agricultural Census, 2005

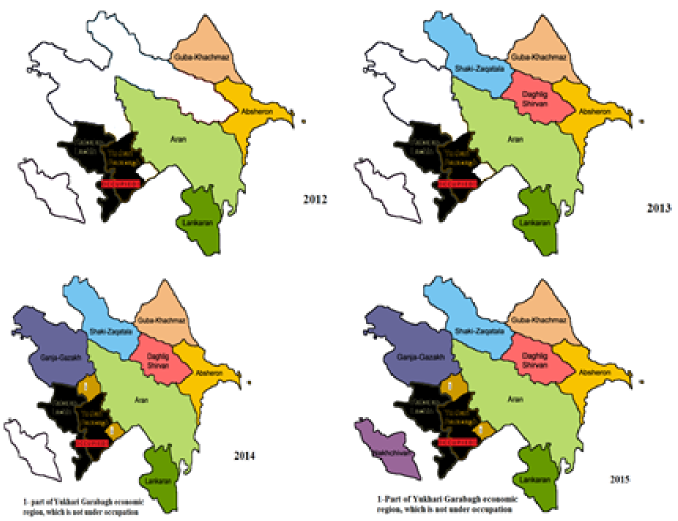
Number of farms in different farm types

Farm types used in FDMS sample plan	UNIVERSE All individual farms	POPULATION Individual farms >1000 AZN Standard Output	SAMPLE FDMS farms (0.5%)
Field crop farms	216 650	106 353	513
Vegetable farms	27 672	27 233	131
Perennial farms	224 452	12 867	62
Livestock farms	295 431	136 642	659
Mixed farms	243 229	131 845	635

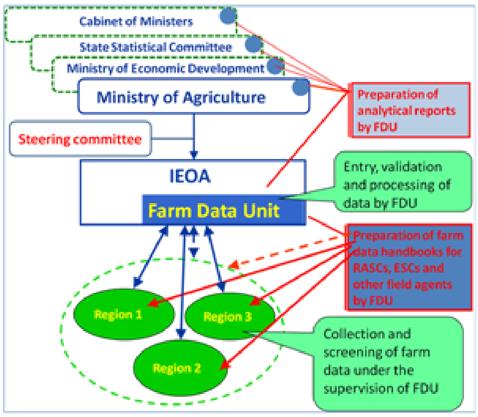
Number of farms by economic regions (0,5% of total)

Economic regions	Farm type: Field crop	Vegetable	Perennial	Livestock	Mixed	Total
Guba-Khachmaz	52	6	22	45	63	188
Lankaran	46	16	13	82	63	220
Aran	179	42	20	256	279	776
Shaki-Zaqatala	59	20	2	70	74	225
Daghlig Shirvan	40	1	1	32	53	129
Ganja-Gazakh	110	27	3	105	63	308
Yukhari Garabagh	13	3	0	13	18	47
Baki	0	1	0	2	0	2
Absheron	1	1	0	11	1	15
Nakhchivan	12	14	2	41	22	90
Total	513	131	62	659	635	2000

COUNTRY-WIDE COVERAGE



Conceptual framework for functioning of FDMS



ANNUAL COST BREAKDOWN (AZN)				
	2012	**2013**	**2014**	**2015**
Personnel	76,632	86,832	97,032	101,112
Travel	45,720	56,520	67,320	71,640
Trainings to data collectors	6,000	6,000	6,000	6,000
Equipment and software	10,500	13,000	15,500	16,500
Reporting and analysis	3,000	3,000	3,000	3,000
General operating expenses	7,600	7,600	7,600	7,600
Grand Total	149,452	172,952	196,452	**205,852**
Sample size	1,203	1,562	1,911	**2,000**
Cost per farm	124	111	103	**103**

Some results of FDMS Analysis

Figure 1: Share of value according to various assets groups

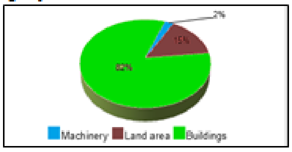


Figure 2: Distribution of the value of machinery by type of farming (AZN per farm)

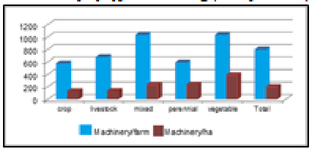


Figure 3: Distribution of educational grade of farm owner

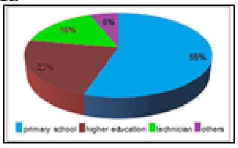


Figure4. Share of gross income, variable costs and gross margin per ha land

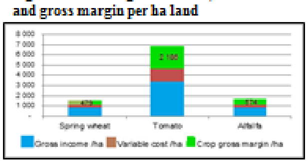
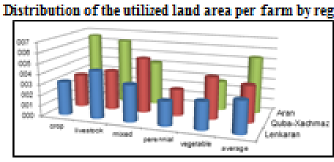


Figure 5: Distribution of the utilized land area per farm by region (in ha)



19 Development of FADN in Turkey

Cemre Ozcanli

REPUBLIC OF TURKEY
MINISTRY OF FOOD AGRICULTURE
AND LIVESTOCK

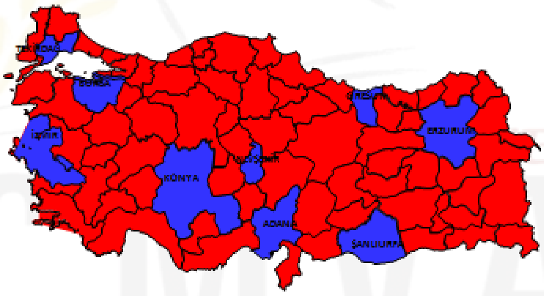
IMPLEMENTATION OF FADN

" Establishment of Pilot Turkish Farm Accountancy Data Network" Project was implemented between August 2007 and January 2009. Within the project;

4

REPUBLIC OF TURKEY
MINISTRY OF FOOD AGRICULTURE
AND LIVESTOCK

IMPLEMENTATION OF FADN



The system has been established in 9 pilot provinces

5

REPUBLIC OF TURKEY
MINISTRY OF FOOD AGRICULTURE
AND LIVESTOCK

IMPLEMENTATION OF FADN

❖ "Extending the Pilot FADN Project and Ensure Sustainability" project started in May 2011

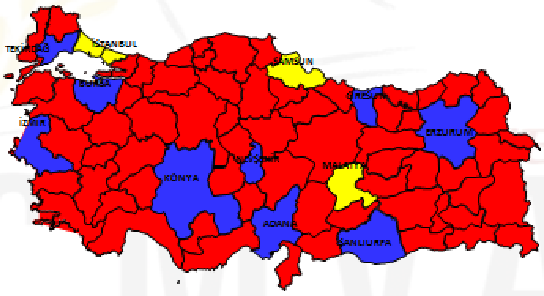
<u>Objective</u>:

❖ To extend the Turkish FADN system within 12 Regions at NUTS 1 level and ensure its sustainability.

❖ Twinning partners are Holland, Germany and Sweden consortium.

7

IMPLEMENTATION OF FADN



The system has been extended to 12 provinces (Samsun, Malatya and Istanbul)

8

IMPLEMENTATION OF FADN

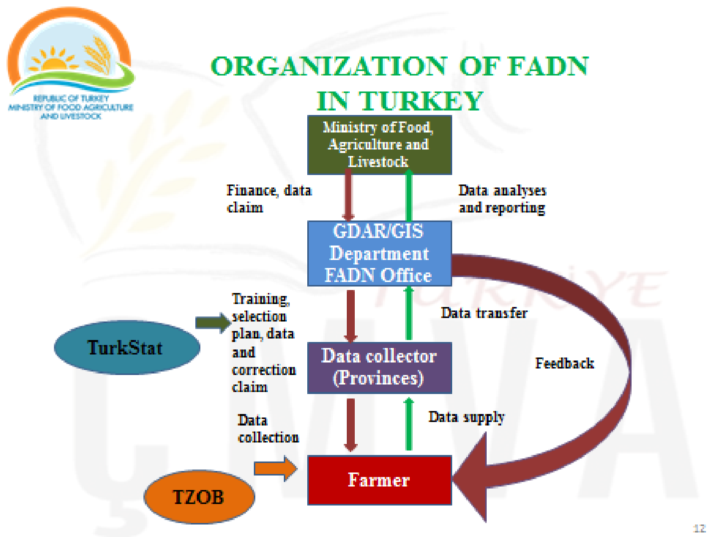
- Data have been collected from 600 holdings
- Trainings were organized for data collectors
- 350-farm-data were sent to RICA1 system

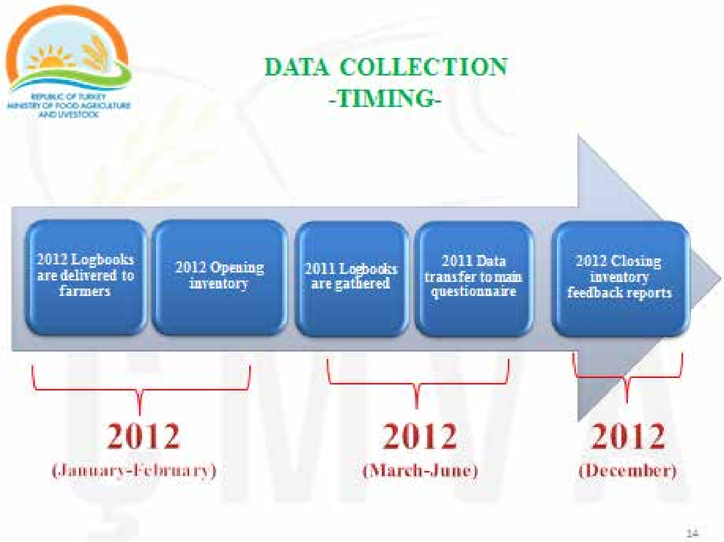
9

IMPLEMENTATION OF FADN

Awareness campaigns	Stakeholder analysis
	

10

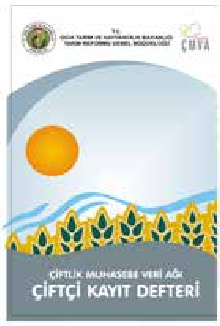




DATA COLLECTION

Data is collected from the holdings; by the data collectors.

Logbook is delivered to the farmers in order to provide them to keep their records



12

DATA COLLECTION
Logbook

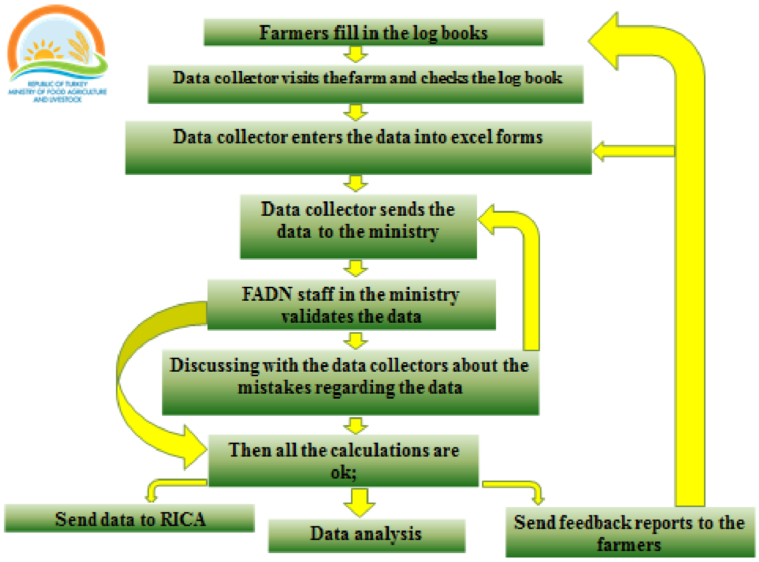
COSTS-PURCHASES				
Transaction code	Date	Type of transactions	Amount and unit (head, m², Ton vb)	Total amount (TL)
	—..	——	—..	——
	—..	—..	—..	—..
	05.05.2011	Hoeing (For cotton)	10 persons-45 TL	450
	17.08.2011	20x20 fertlizer was bought .	700 kg	518
	18.08.2011	Buğday taşıma ücreti	1 time	150
	27.09.2011	Repairs	300 TL for equipment, 250 TL for labour	550
	.....	.....	.....	.....

13

DATA COLLECTION
Logbook

REVENUES-SALES				
Transaction code	Date	Type of transactions	Amount and unit (head, m², Ton vb)	Total amount (TL)
	—..	—..	—..	—..
	—..	—..	—..	—..
	22.10.2011	Wheat was sold	5 Ton	4650
	24.10.2011	Plowing	25 da/14 TL	350
	27.11.2011	Insurance compensation	19 da grain maize	1350
	31.12.2011	Olive was sold	750 kg olives	2650
	—..	—..	—..	—..

14



20 Status of FADN in Kosovo

Hakile Xhaferi

Ministry of Agriculture, Forestry and Rural Development

FADN(Farm Accounts Data Network)in Kosova

Hakile Xhaferi
Chief of Statistics Division
Department of Economic Analysis and Agriculture Statistics
MAFRD

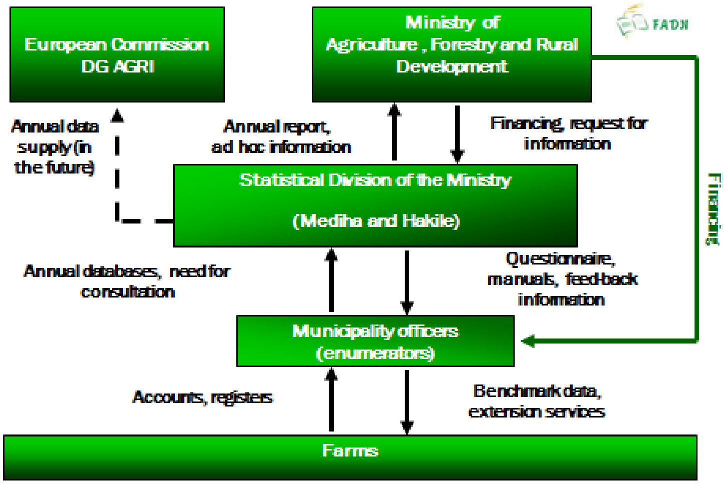
30.09-03.10. 2012
Rome

Ministry of Agriculture, Forestry and Rural Development

Short overview of the presentation

I. Organisational structure of the FADN system of Kosovo
II. Background
III. FADN sampling
IV. FADN data collection, New development activities
V. Summary
VI. Plans for the future

I. Organisational structure of the FADN system of Kosovo



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II. Briefing on Farm Accountancy Data Network (FADN)

- The Farm Accountancy Data Network (FADN) system in Kosovo is still underdeveloped(started in 2008 with 300 farms), mainly due to the lack of reliable data on:
- Agricultural population of farms, weak and not fully developed system;
- Inadequate information technology (IT) background and the shortage of personnel;

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III. FADN Sampling

- Based on Household Statistics Survey(KSA), 192 thousand agricultural households are estimated to exist in Kosovo.
- Out of this number only 5,000 farms are above 1 European Size Unit which forms the field of observation of the FADN.
- Recent FADN data collection collects data from 300 farms which give a 6% selection rate.

*Last Agriculture Census in Kosova was conducted in 1960

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Continuation

- After the finishing of the calculation of SO coefficients the classification of FADN sample farms have been accomplished.
- This has revised the true structure of agriculture of Kosovo for the first time by using EU methodology.
- Data collected and processed from the sample farms will represent the agricultural sector of Kosovo.

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IV. FADN data collection, & development activities

- For further testing and for the validation of the new questionnaire farm visits have been organised .
- The questionnaire was performing considerably well, however it will take time for the enumerators to get familiar with it.
- We tested the software by entering the freshly collected data.
- Although data entry was fairly simple, at the same time few deficiencies were detected

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FADN Results(I)

- Based to the results farms with grazing livestock (mainly dairy cows) and the mixed crops and livestock farms are the most important segments of the agricultural sector of Kosovo.
- According to these results Kosovo has about 192 thousand agricultural farming units * (farms) of which about 49%, (93 thousand) is above the 2000 € SO, forming the field of observation.
- They produce the 82% of the total production value.

*Last Agriculture Census in Kosova was conducted in 1960

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FADN Results(II)

- Standard Output coefficients was achieved as the classification of the sample farms and the farms in the AHS 2008 was completed.
- All farms in total in 2008 have produced an estimated production value of 573 million Euro.
- Farms below the threshold (51% of the total population) have produced 18% of the total production value while farms above the threshold level produced the 82%.
- The selection plan of Kosovo needs to be revised as some of the types like mixed animals are not represented

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V. Summary

•By this method we are able to reconstruct the structure of the agricultural sector of Kosovo.

•This will serve as the universe of farms forming the basic population of farms of Kosovo until the Agricultural Census will take place and the original structure of agriculture will be revised.

•Managing to calculate the total Standard Output for Kosovo for 2008 estimating the potential of the sector and at the same time identifying the key branches of agriculture.

FADN Distribution of Sample farms

General type	Economic size classes											Total
	1	2	3	4	5	6	7	8	9	10	11-14	
Arable crops	3	6	3	6	5	7	4					34
Horticulture	1		4	9	7	3	4	2		1		31
Permanent crops		1	1	1	1	2						6
Grazing livestock		1	7	18	26	26	13					91
Pigs and poultry						2	2					4
Mixed horticulture and permanent crops		1	1	6	3	6	1					18
Mixed animals												
Mixed crops and animals		4	19	21	15	11	2	3				75
Total	4	13	35	61	57	57	26	5		1		259

NUMBER OF FARMS INCLUDED IN FADN for 2009

Farms in the agricultural household survey, 2008

General type	Economic size classes											Total	Above thres-hold
	1	2	3	4	5	6	7	8	9	10	13		
Arable crops	330	38	16	11	13	23	18	8	4	1		462	132
Horticulture	37	8	15	22	23	20	2	1				128	91
Permanent crops	24	4	7	13	4	1						53	29
Grazing livestock	479	496	342	129	50	44	13	3	1			1557	1078
Pig and poultry	27	1	1	2	1	2	3	3	1		2	43	16
Mixed horticulture and permanent crops	182	66	72	45	19	18	7	1				410	228
Mixed animals	113	135	71	14	1	1						335	222
Mixed crops and animals	290	573	398	109	19	19	5	3				1416	1126
Total	1492	1321	922	345	130	128	48	19	6	1	2	4414	2922

Total Number of Farms

General type	Economic size classes											Total	Above thres-hold
	1	2	3	4	5	6	7	8	9	10	11-14		
Arable crops	20,487	1,126	507	351	230	231	162	53	4	1		23,153	2,666
Horticulture	2,672	519	672	746	210	116	25	1				4,960	2,288
Permanent crops	1,385	181	143	185	14	1						1,909	524
Grazing livestock	31,787	22,146	10,606	2,337	699	153	51	3	1			67,783	35,996
Pig and poultry	1,886	107	55	142	1	2	3	3	1		2	2,202	316
Mixed hort. and perm. crops	12,204	3,038	2,270	1,016	201	119	7	1				18,856	6,652
Mixed animals	7,687	6,331	1,899	346	1	1						16,265	8,578
Mixed crops and animals	20,069	24,393	9,956	1,932	317	174	18	3				56,862	36,793
Total	98,733	57,841	26,108	7,056	1,674	796	265	64	6	1	2	192,547	93,814

FADN

Total production (million Euro)

General type	Economic size classes											Total	Above thres-hold
	1	2	3	4	5	6	7	8	9	10	11-14		
Arable crops	11.8	3.3	2.8	3.8	4.7	8.4	11.8	5.7	1.5	0.7	0.0	54.4	42.6
Horticulture	1.5	1.5	4.3	7.8	4.1	3.8	1.5	0.1	0.0	0.0	0.0	24.7	23.1
Permanent crops	1.3	0.6	0.8	2.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	5.1	3.9
Grazing livestock	40.6	61.1	58.0	24.8	13.6	5.0	3.2	0.4	0.4	0.0	0.0	207.1	166.5
Pig and poultry	0.6	0.4	0.4	1.7	0.0	0.1	0.2	0.5	0.3	0.0	4.0	8.2	7.6
Mixed hort. and permanent crops	9.7	8.6	12.2	11.0	3.7	3.4	0.5	0.1	0.0	0.0	0.0	49.1	39.5
Mixed animals	11.8	17.9	9.6	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.8	31.0
Mixed crops and animals	27.9	68.4	53.7	19.2	5.8	5.3	1.0	0.4	0.0	0.0	0.0	181.9	153.9
Total	105.2	161.8	141.8	74.0	32.3	26.1	18.2	7.2	2.2	0.7	4.0	573.3	468.1

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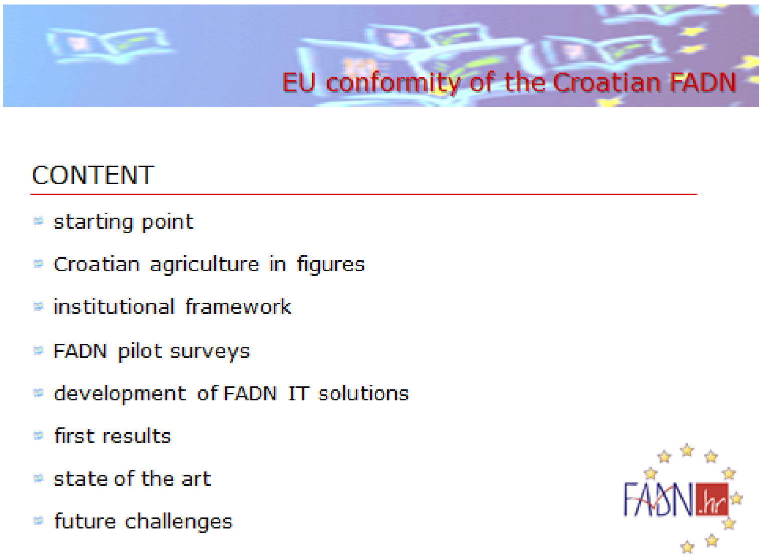
VI.Concrete plans for the future

- After the classification of the types and economic size of the sample farms, has become clear that the existing sample farm structure does not represent all the farms in the AHS.
- The revision of the sample has to take place
- 1. Elaboration of a Selection Plan on the basis of the population data.
- 2. Incorporation of the control algorithms into the new data processing software.
- 3. Training of the enumerators

21 EU conformity of the Croatian FADN

Kristijan Jelakovic



EU conformity of the Croatian FADN

INTRODUCTION

- benchmark for negotiations with EU
- implementation of the EU acquis in statistics
- lack of experience in similar surveys
- technical assistance (WB project)
- institutional co-operation
- organization of Laision Agency
- data collection preparation

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OBJECTIVE

- implementation of EU FADN methodology
- collection of structural, economical and financial farm data
- ensure the confidentiality of individual farm data
- development and maintaining of data base
- data transmission to the EC
- data analysis for national stakeholders
- preparation of (standard) results and reports
- fully functional Croatian FADN system

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ASSUMPTIONS

- creation of the legal base
- institutional co-operation
- building questionnaire and manual for data collection
- SGM/SO coefficients calculation
- education of data collectors
- development of IT solutions

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RISKS

- old administrative sources (Agricultural Census 2003)
- Farm Structure Survey not conducted
- voluntary participation of farmers
- accountancy approach on farm level
- Farm Return content
- data quality issues
- lack of human and financial resources

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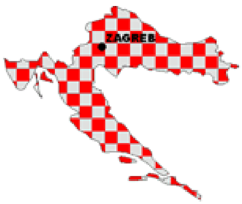
CROATIA IN FIGURES

total surface:	87 661 km^2
continental surface:	56 594 km^2
sea surface:	31 067 km^2
sea coast length:	5 835 km
islands, cliffs and reefs:	1 185
population:	4 290 612
rural population:	47,6%
GDP per capita:	10 682 €



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CROATIAN AGRICULTURE facts & figures

eurostat

number of holdings:	181 252
average size:	5,4 ha
utilised agricultural area:	978 671 ha
arable land:	729 080 ha
kitchen gardens:	1 940 ha
permanent grassland:	173 950 ha
permanent crops:	50 010 ha
forest area:	92 100 ha
total standard output:	1 372 655 €
total livestock:	861 700 LSU

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INSTITUTIONAL FRAMEWORK

- Ministry of Agriculture (MofA)
  National FADN Committee
- Agriculture Advisory Service (AAS)
  Liasion Agency for croatian FADN
- Croatian Bureau of Statistics (CBS)
  clasification of farms, sampling activities
- Faculty of Agriculture (FA)
  data analysis

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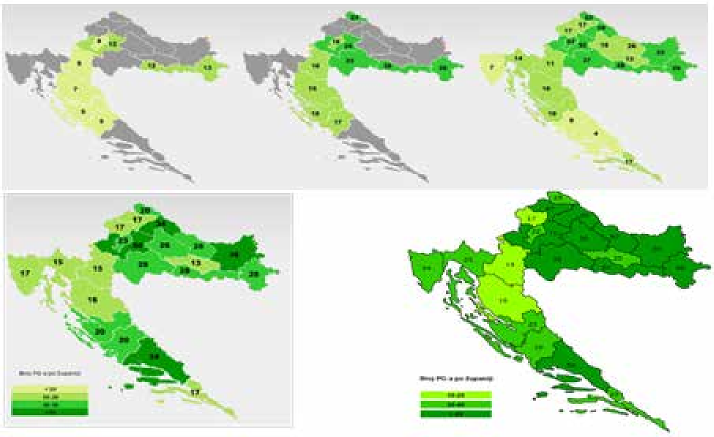
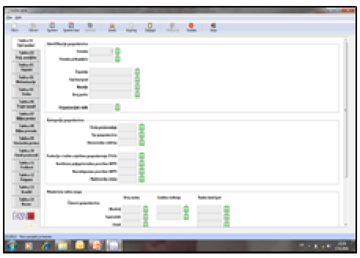
FADN PILOT SURVEYS 2008 - 2011



EU conformity of the Croatian FADN

CROATIAN FADN IT SYSTEM

- offline software tool with online connection for uploading data
- programming language is PHP with some extensions so the user interface is build in Glade builder
- data files are saved locally in XML format
- DBMS is MySQL
- web application for generating reports on server
- all scripts are written in PHP



EU conformity of the Croatian FADN

FADN FIELD OF OBSERVATION

Type of farm	Economic size classes I	II	III	IV	V	VI	TOTAL
1. Specialist field crops	4.817	1.821	1106	398	154	28	**8.324**
2. Specialist horticulture	435	390	61	78	11	0	**976**
3. Specialist permanent crops	6.827	1.862	101	18	25	14	**8.847**
4. Specialist grazing livestock	13.502	9.715	2.741	756	150	27	**26.892**
5. Specialist granivores	3.980	1.095	241	55	82	20	**5.473**
6. Mixed cropping	5.946	1.380	253	37	11	9	**7.635**
7. Mixed livestock	12.701	7.474	696	125	7	2	**21.006**
8. Mixed crops - livestock	23.322	6.199	832	267	74	3	**30.697**
TOTAL	**71.529**	**29.936**	**6.031**	**1.735**	**514**	**103**	**109.849**

EU conformity of the Croatian FADN

FADN REPRESENTATIVE SAMPLE

Type of farm	Economic size classes I	II	III	IV	V	VI	TOTAL
1. Specialist field crops	30	36	38	42	66	28	**240**
2. Specialist horticulture	25	22	15	11	11	0	**84**
3. Specialist permanent crops	32	29	10	7	22	14	**114**
4. Specialist grazing livestock	42	47	52	56	51	27	**275**
5. Specialist granivores	24	28	18	15	29	20	**134**
6. Mixed cropping	36	31	15	11	11	9	**113**
7. Mixed livestock	25	27	19	12	7	2	**92**
8. Mixed crops - livestock	55	45	34	31	28	3	**196**
TOTAL	**269**	**265**	**201**	**185**	**225**	**103**	**1.248**

EU conformity of the Croatian FADN

SELECTION PLAN 2012

ES6	farms	% (inv.)	UAA	% (inv.)	TSO	% (inv.)	LSU	% (inv.)
0	71.403	*100,00%*	53.487	*100,00%*	61.336	*100,00%*	47.648	*100,00%*
I	71.529	*60,61%*	217.629	*94,53%*	307.032	*95,53%*	199.616	*94,60%*
II	29.936	*21,14%*	264.874	*72,30%*	400.790	*73,16%*	255.543	*71,99%*
III	6.031	*4,63%*	152.630	*45,23%*	207.676	*43,97%*	125.454	*43,05%*
IV	1.735	*1,30%*	96.892	*29,64%*	113.384	*28,84%*	61.152	*28,84%*
V	514	*0,34%*	66.783	*19,74%*	84.476	*20,58%*	43.321	*21,92%*
VI	103	*0,06%*	126.376	*12,91%*	197.961	*14,42%*	150.178	*17,01%*
TOTAL	**181.252**		**978.671**		**1.372.655**		**882.912**	

109.849 farms

925.184 ha

FADN
representative sample
1.248

EU conformity of the Croatian FADN

FIRST REPORTS

1. FADN individual farm report
   structural and economical indicators
   financial reports
   (profit and loss account, balance sheet)
2. STANDARD RESULTS
   aggregated data for national
   policy makers
3. FARM RETURN

EU conformity of the Croatian FADN

CURRENT SITUATION

- data collection for accounting year 2011 conducted on 753 returning holdings
- data processing in place
- implementation of the Twinning Light project: „Verification of EU conformity of the Croatian FADN" with purpose of strenghtening of existing FADN system in accordance with EU requirements (assessment, monitoring and enhancement)

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EU conformity of the Croatian FADN

FUTURE CHALLENGES

- usage of RICA 1 and CIRCA systems
- full harmonization with EU requirements
- EU accession on 1 July 2013
- FADN representative sample based on FSS
- question of FADN regions/divisions
- transmission of the first FARM RETURN in 2014
- implementation of NEW FARM RETURN
- data use

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22 FADN in Macedonia

Alexander Musalevski

Institutions included in the Macedonian FADN

- Ministry for Agriculture, forestry and water economy;
- National committee for FADN;
- FADN Unit within Ministry for Agriculture, forestry and water economy (Liaison agency);
- Body for collecting of data – National Extension Agency;
- State Statistical Office.

Ministry for Agriculture, forestry and water economy

- Single State Authority which have competence for establishing and implementation of Macedonian FADN and is the only user of the FADN data;
- Approves the Selection Plan;
- Approves the contract for collection of data;

National Committee for FADN

- Constituted by Government , proposed by Ministry for Agriculture, Forestry an Water Economy
- Gives opinion to the Minister concerning to collecting, processing and usage of the data
- Gives opinion for the Selection Plan
- Gives opinion for Report the Selection Plan.

National Committee for FADN

- National Committee has 10 members:
- 2 members appointed from Minister,
- 2 members appointed from Minister of finance,
- 1 member from the Faculty of agriculture and food – Institute for Agro economy,
- 1 member from FADN Unit,
- 1 member from SSO,
- 1 member from NEA,
- 1 member from cooperatives and farm associations,
- 1 member from economic chambers.

Liaison Agency – Unit for FADN

- Defines FADN Region,
- Prepares SO coefficients,
- Approves the Selection Plan,
- Prepares report for realization of Selection Plan,
- Verifies the data in the Farm Return.

Liaison Agency – Unit for FADN

- Prepares and publishes the data in publications,
- Communiction and delivery of data to EC (Rica),
- Delivers the data to the other institutions,
- On request of Liaison Agency, National Committee, NEA and SSO are obliged to deliver all required information's and data.

Body for collection the data - NEA

- NEA have role of body for collecting of data,
- Make contracts with farmers which are included in FADN system,
- Helps on farmers for preparing of data,
- Collects data and insert the data into the software,
- Send the data to the Liaison Agency.

State Statistical Office

- SSO has role in section of farms (preparing of the Selection Plan) based on data from Agriculture Census,
- On request on Liaison Agency prepares Selection Plan,
- Liaison Agency and SSO are responsible for establishing typology of farms.

Collecting of data

- Data from farm are collected by advisors in NEA;
- 93 advisors are collecting data from 600 farms according to Selection Plan for 2012;
- 6 visits per year.

Problems, solutions and status of the problems in the FADN system in the R. Macedonia

- Farmer are afraid to provide data for FADN system;
- *MAWFE will promote the FADN system among farmers, farmers union and the economic chambers (on going);*
- Lack of financial recourses for data collectors;
- *Financing of the system to be in the MAFWE budget (on going);*
- Lack of IT specialist in the FADN Unit;
- *Contract with IT company which will satisfy the needs of the FADN system (finished) and IT specialist to be employed in the Unit (future action);*

Problems, solutions and status of the problems in the FADN system in the R. Macedonia

- Procedures of controlling the data collection by FADN Unit in order to improve the quality of the data;
- *It is recommended to control at least 5% of advisors every year (on going);*
- Introducing the data management (quality control, calculations and reporting);
- *In the next phase it is planed to introduce data management in the system (future action);*

Problems, solutions and status of the problems in the FADN system in the R. Macedonia

- Payment of the data should be made upon error free electronic files and upon a list of signed farm reports.
- *Contract with NEA (on going);*
- FADN data set must be error-free in the Rica 1 control system;
- *We have Rica 1 training password system and we are testing the 2011 data set (on going);*

23 Changes in the EU farm return

Piotr Bajek and Eva Nagy

New FADN Farm Return regulation

Commission Implementing Regulation (EU) No 385/2012 of 30 April 2012 on the farm return to be used for determining the incomes of agricultural holdings and analysing the business operation of such holdings

(OJ L 127, 15.5.2012, p. 1–55)

20th PACIOLI workshop 2

Contents of the presentation

- Main changes in comparison with the current farm return regulation
- Elements which will be included in the manual/instructions to the farm return regulation
- Important technical changes

Table A – General information of the holding

- *PDO/PGI* (voluntary)
- *Approximate location of farm* – rounded to nearest 5' latitude and longitude
- In practice 15' will apply when only 1 farm in a 5'x5' rectangle. Rectangle 5'x5' is about 9.2x5.2 km (15'x15' is about 28x16 km). This data is NEVER disclosed and will be used only for grouping farms. Some MS have derogation to the rules if confidentiality could be compromised.
- *Irrigation system*
  - surface / sprinkler / drip / other / not applicable (when no irrigation on the farm)

Table B – Type of UAA

- *Kitchen gardens in the UAA*: only the area – no further information wanted

Table C - Labour

- *Share of OGA labour in total work:* share of work for Other Gainful Activities directly related to the holding (OGA) in % of annual work units (an estimate)
- *Gender*
- *Agricultural training of the manager*

20th PACIOLI workshop 6

Table D (ex-G) – Assets

- Use of the most applicable valuation methods (fair value, historical cost, book value)
- More details for current assets (cash, receivables) and intangible assets (tradable, non-tradable)
- Application of International Accounting Standards (IAS) and International Financial Reporting Standards (IFRS) where needed
- If some data are not available – a proxy would be used and communicated

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Table E (ex-L) - Quotas

- A shorter list of quotas

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Table F (ex-H) - Debts

- Instead of recording purpose, focus on the source of debt:
  - commercial standard,
  - commercial special,
  - family/private loans,
  - other liabilities,
  - payables.
- Family/private debt could also be reported in "other liabilities".

Table G (ex-I) - VAT

- Simplified
  - only two VAT systems
  - VAT balances for investment/non-investment reported for one system only

Table H (ex-F) - Inputs

- Veterinary costs separated
- Quantity of N, P2O5 and K2O in used mineral fertilisers
- Value of bought manure
- Specific costs for OGA: for processing crop products, milk of cows, buffalos, ewes, goats, meat and other

Table H (ex-F) - Inputs

- Costs of agricultural insurance separated
- Interest and financial charges simplified into one item

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Table I (ex-K) - Crops

- New data by crop:
  - quantity of sales
  - area used for GMO
- *New way of recording:*
  - *irrigated area*
  - *area used for energy crops*

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Table J (ex- D, E, N) - Livestock

- **Destination of sales:**
  - for slaughtering,
  - for further rearing or breeding,
  - unknown destination.
- **Weight of animals** sold with a destination of slaughtering : collected at "regional" level and transmitted as a complementary file.

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Table K (ex-K) - Animal products and services

- New variables:
  - buffalo's cows' milk,
  - manure (value of sales only),
  - quantities of opening, closing, sales, farmhouse consumption, farm use.

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Table L (ex-K) - Other Gainful Activities (OGA)

New item: production of renewable energy

The farm products used for further processing

- **In the Tables for production** (Crops, Animal and Animal products) **: recorded under farm use**
- **In the Table for costs**: in the relevant categories of costs for OGA.

The purchases of agricultural product or agricultural processed products:

- **In the Table for costs**: in the relevant categories of costs for OGA.

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Table M (ex-J, M) - Subsidies

- Distinguish between sources of financing:
  - EU,
  - co-financed,
  - national.
- Cooperation with the paying agency should be a convenient solution

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Important technical changes …

- A decimal point is now accepted in all data: financial, average number, labour units, areas, etc.
- The format of the farm return is completely variable: there are no more fixed positions to respect. This is a huge change in the transmission of data.
- The formats used until now will not be possible anymore: no more delimited txt, no more binary fixed length.

… Important technical changes

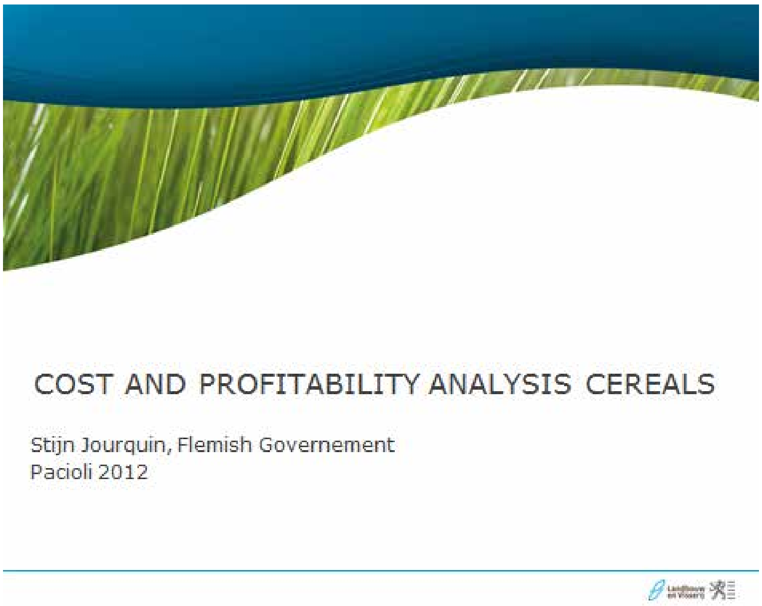
- XML is already accepted by and used extensively in RICA and today is the preferred format for data exchanges in most systems (e.g. Eurostat)
- The new XML format is not yet finalized but the MS have to be prepared for the collection and transmission of their data with this technique
  - a FADN committee working group has been created to help coordinate these IT issues (first meeting on 9 October 2012).

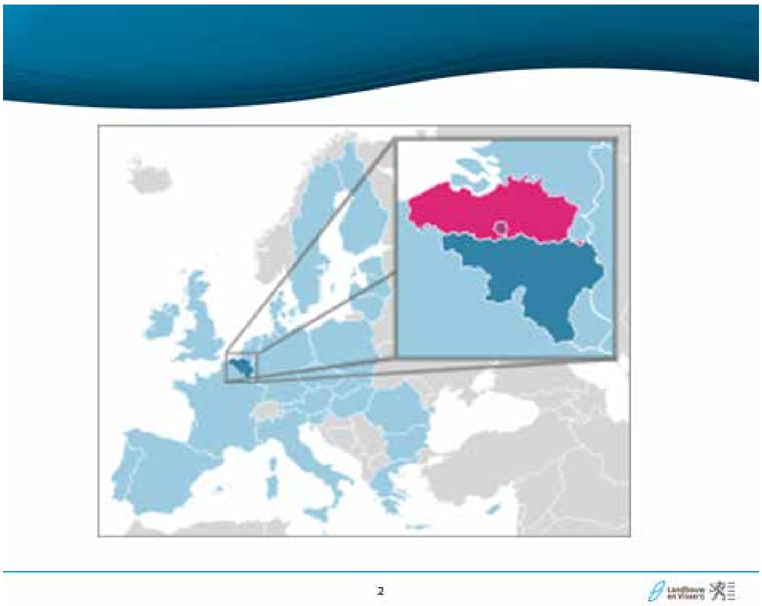
Starting from the accounting year 2014

- Reasons for 2014
  - 2014 starts with the new CAP,
  - discussions to agree changes long,
  - time needed to prepare the new system.
- 2014 data to be delivered to the EU FADN by the end of 2015 and published for all EU in 2016
- Quantity of N, P2O5 and K2O in used mineral fertilisers – a transition period till accounting year 2017 possible

24 Cost and profitability analysis for wheat, barley and maize

Stijn Jourquin





Introduction: cereals in Flanders

- 26 000 farmers, 620 000 ha agricultural land
  - 45% sand
  - 34% sandy silt
  - 11% clay
  - 10% silt

- Cereals:
  - 14 000 farmers
  - 149 000 ha or 24% agricultural land
  - 48% wheat, 40% grain maize, 8% barley
  - Cultivated on the different soil types

3

Methodology

- Taxes, social security and subsidies not included
- All costs: operating costs and other farm costs

- Rentability indicator:
  - family labour income (FLI)
  - =revenue - all costs except (unpaid) familiy labour costs

- Variation indicator:
  - mean of 50% highest – mean of 50% lowest

- Outliers removed
  - Outlier = outside the range <mean +- 4 * standarddeviation>
  - Variables: family labour income (euro/ha) and yield (ton/ha)

4

Mean results 2006-2010 (euro/ha)

	Wheat	Grain maize	Barley
Yield (ton/ha)	8,2	11,5	7,6
Revenue*	1.639	1.365	1.330
Grain Sales	1.322	1.289	1.047
Other (Straw, Inventory differences...)	317	76	283
Operating costs*	**716**	**666**	**609**
Seeds	90	154	99
Fertilisers	138	85	118
Crop protection	210	103	155
Contract labour	212	254	174
Other operational costs	66	70	63
Gross margin**	**923**	**699**	**721**
Other farm costs*	**636**	**613**	**589**
Rent paid	167	158	146
Cost own land	56	62	45
Machinery upkeep	61	62	54
Depreciations	189	175	183
Cost of own capital	99	84	94
Other	64	71	65
Total cost (family labour costs exluded)***	1.352	1.279	1.198
Family labour income (FLI)***	287	87	132
Family labour costs*	304	375	373
Net economic margin****	-17	-288	-241
Difference FLI 50% farms highest and 50% farms lowest FLI	722	695	717

Methodology: Lineair Regression Model

- What explains the variation in rentability (FLI)?
- Independent variables:
  - Year: 2006, 2007, 2008, 2009, 2010
  - Agricultural area used: 0-20, 20-40, 40-60, 60-80, >80ha
  - Soil type: clay, silt, sandy silt and sand
  - Type of farm: specialized in arable farming or not
  - Use of own products (grain or straw): yes or no
  - Age/succession farmer: <45 year, >45 year + successor, rest
  - Agricultural education farmer: yes or no

Lineair regression results

- Percentage of variation explained:
  - Wheat: 53%
  - Grain maize: 43%
  - Barley: 52%
- Year: significant differences because of pricevolatility
  - Good years 2007 and 2010 ⇔ 2006, 2008 and 2009
- Agricultural area used: bigger farms perform better
- Soil type: significant differences for wheat and barley
  - Better yield on clay and silt

7

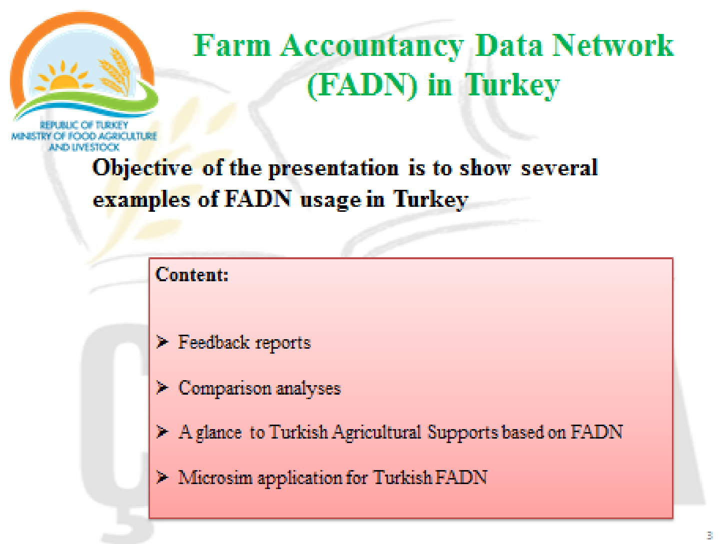
Lineair regression results

- Type of farm: not-specialized farmers + users of straw and grain for own cattle perform better
  - The 'other farm costs' are lower
- Wheat growers using own grain for seed perform better.
  - The operating costs are lower
- Young farmers obtain higher yields for wheat and barley
- Agricultural education: not significant

8

25 Economic analysis with Turkish FADN data

Murat Aslan



Farm Accountancy Data Network (FADN) in Turkey

Feedback report contents:

- General farm characteristics
- Specification balance and financial indicators
- Income characteristics
- Specification income and outputs
- Specification inputs
- Specification income and outputs (da)
- Specification inputs (da)
- Yields and profits per crop
- Comparison of the farms
- Investment plans

5

TR-HOL Comparison

Methodology:

- First the results of both Turkish and Dutch arable farms are looked at. The goal is selecting a group of similar Dutch and Turkish farms.
- The selection criteria are set on: total area bigger than 20 hectare and % cereals in total area > 40%
- The weighting factors are calculated with statistical matching (program Stars). Only the Turkish farms who have the most similarities with the selected Dutch farms are getting a weighting factor.

8

TR-HOL Comparison

Selected Turkish farms

Farm Number	Cereals_ha	Cereals_share_area	UAA_ha	Share_total_output
141	10	40	25	53
312	45	41	109	51
177	44	41	106	27
348	11	42	28	19
169	157	43	369	42
151	11	43	28	28
368	15	43	35	34
8	22	43	50	12
302	12	44	23	32
343	39	44	88	13
280	19	44	42	42
165	75	45	168	43
265	13	45	29	11
154	100	45	223	48
282	45	45	100	35
178	202	46	440	53
323	20	---- 46	43	21
182	23	47	60	45

9

TR-HOL Comparison

Farm structure		
	Netherlands	Turkey selected farms
Number of farms	53	75
Total utilised area (ha)	85,1	84,6
% cereals in total area	53,8	53,7
% output cereals in total output	16,9	40,5
% oilseeds in total area	0	24
% potatoes in total area	20	0
% sugarbeet in total area	12	1

11

TR-HOL Comparison

	Standard results	Holland	Turkey
Code	Name	euro	euro
SE430	Farm Net Income / FWU	59.210	20.411
SE270	Total inputs euro	249.919	80.945
SE131	Total output euro	297.784	122.700
SE605	Total subsidies excluding on investments	35.009	10.188
SE420	Farm Net Income	77.776	47.526
SE020	Paid labour AWU	0,2	2,4
SE015	Unpaid labour FWU	1,3	2,3
SE340	Machinery & building costs (upkeep e.o.)	21.254	4.079
SE360	Depreciation	45.786	7.976
SE455	Machinery euro	203.713	47.490
SE436	Total assets	3.325.769	766.125
SE485	Total liabilities	550.371	19.345

12

TR-HOL Comparison

Calculated ratios		
	Netherlands	Turkey selected farms
Income / FWU as percentage of total costs	4	4
Subsidies / (total output + subsidie)	11	8
(total output + subsidies) / total input	133	164
Subsidies / Farm net income	45	21
Family labour AWU / total labour	0,9	0,5

13

Support structure of FADN farms in Turkey

Aim:

- Reviewing the impact of subsidies in Turkish Agriculture.
- After checking consistency of data and removing outliers, data of 506 farms were used in the statistical analysis.

15

Support structure of FADN farms in Turkey

Farm Type	Number of observations (n=506)	Total Utilized Agricultural Area (SE025)	Total Output (SE131)	Total Subsidies (SE605)	Subsidies per ha	Subsidies per AWU
	n	ha	TL	TL	TL/ha	TL/AWU
Arable	248	45.0	194,766	21,940	488	5,928
Horticulture	3	32.9	125,570	1,332	41	400
Permanent crops	128	21.7	118,920	22,556	1,041	3,118
Grazing livestock	47	23.6	120,939	12,128	514	3,724
Mixed crop	43	40.0	144,569	15,736	394	4,724
Other mixed	37	28.9	106,871	13,478	466	3,768
Average		35.4	157,619	21,891	618	4,710

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Support structure of FADN farms in Turkey

Farm Type	Share of subsidies in		
	farm income (SE420)	output (SE131)	GVA (SE410)
	%	%	%
Arable	24.9	10.7	19.7
Horticulture	2.3	0.8	1.6
Permanent crops	38.1	24.7	25.9
Grazing livestock	21.0	29.8	16.2
Mixed crop	21.7	9.4	16.2
Other mixed	68.6	13.2	18.3
Average	30.7	16.0	20.4

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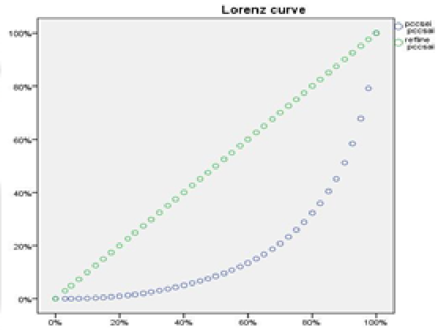
Support structure of FADN farms in Turkey

Gross income of FADN farms in Turkey



Gini = 0,6
Gini (S) = 0,63

%60 of the farms share %15 of Gross Income and %20 of the farms share 2/3 of Gross Income

18

Microsim Application in Turkish FADN

CASE STUDY: INTRODUCTION SAPS IN TURKEY WITH A FLAT RATE OF 182 EURO/HA AND TOP UP OF SUBSIDIES ON LIVESTOCK AND ENVIRONMENT

- The model is based on **farm level FADN data in Turkey**, and each farm is modeled individually.
- Therefore it is ready to take various market situations, currency rates, and subsidy scenarios, including specific subsidies based on quotas, area, animal head count etc.

20

Microsim Application in Turkish FADN

Following policy issue is simulated:

Introduction of Single Area Payment System (SAPS) in Turkey with a flat rate (fixed premium per hectare) and additional top up of subsidies on livestock and environment.

With the model the effects are simulated on the influence on **family farm income** for the years 2011 – 2013.

- Data from Turkish FADN on accounting year 2010. In this year 577 farms are included
- Implementing available price index for some **input** and **output**
- €182/Hectare in 2013

21

Microsim Application in Turkish FADN

- In the model the firm will receive the maximum payment of 182 EUR/Ha in 2013. Due to the phasing in the flat rate, the subsidy in the model is calculated in 2011 on 80%, 2012 on 90% and in 2013 on 100% of the amount of 182 EUR/Ha.
- We used an exchange rate (EUR/TL) of 2,3134 (exchange rate of 3 may 2012). So SAPS is 421 TL/Ha in 2013.
- Besides the introduction of SAPS we made, in consultation with the FADN-team, the assumption that the following subsidies are maintained for the period 2011-2013 at the amount the farmers received in 2010.

Total subsidies on livestock
Subsidies dairying
Subsidies other cattle
Subsidies sheep and goat
Other livestock subsidies
Environmental subsidies
LFA subsidies
Rural development subsidies

22

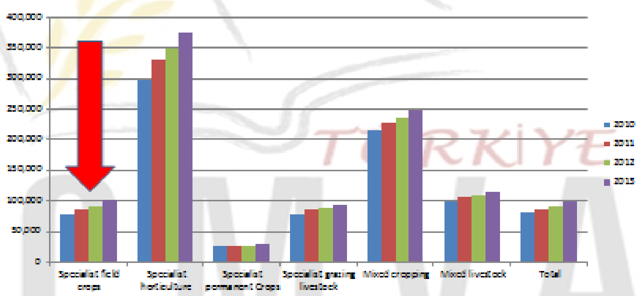
Impact Assessment of new subsidy scheme (TL)

		Turkey is a new EU Member State			
INCOME		2010	2011	2012	2013
Total output	SE131	171.364	184.551	192.761	204.529
Total intermediate consumption	SE275	70.648	75.029	78.787	83.090
Gross farm income	SE410	109.117	117.854	123.768	132.697
Farm net value added	SE415	102.873	111.235	117.024	125.828
Total external factors	SE365	23.211	24.706	25.907	27.401
Family farm income	SE420	80.134	87.001	91.590	98.900

Total income: %19
Net margin: %23

23

Family Farm Income(TL)



Field crops: %30
Fruit and vegetables: %26
Total: %23

24

26 Spouse's involvement - effects on net income and family income

Anna Milford and Torbjorn Haukas

Abstract

Family farming has dominated the Norwegian agriculture through decades. The constitution from 1814 state clearly the allodial right acquired by inheritance for the oldest boy in the family for farms above a certain size and farms been in the family for at least twenty years. This law was changed in 1975, and now the oldest child, boy or girl, has the same allodial right to the farm.

In spite of the intensions of this law, most of the farms are still owned by men (85 per cent), and among the participants in the Norwegian FADN only 9 per cent are women (2010). The difference in gender distribution between the farmer and the owner is caused by the requirement in the Norwegian FADN to use the manager of the farm as the main farmer. This is historically based on most working hours in the production and management of the farm. In the annual survey registration of labor input is important. Many of the performance measurements are connected to results measured by labor input, like earning capacity per hour and return on labor and per working year. The labor input is registered for farmer, spouse, children, paid and unpaid labor. The farmer's gender is registered in the database and in the survey we assume that the spouse has opposite sex.

The role of the spouse has changed during the last decades. Some decades ago the farmer and the spouse used all their labor on the farm, and often other family members were involved in the farm work. The farm was the live project for the family, and the income from farming kept the whole family alive. The Norwegian farms are small compared to farming in the rest of Western Europe. Modern technology and more efficient ways of farming combined with fewer and bigger holdings have led to less need for labor on the farms. The distant family labor like uncles and aunts and other unpaid labor were the first people to leave the farm. Then the spouses started to work outside the farm in addition to farming, and during the last years also the farmer has some work outside the farm. The development is caused by many factors, but less profitability in farming compared to other sectors and new technology are the main courses in addition to the need for a social life outside the farm.

In this project we have studied the development of the spouse's participation in farm work during the last twenty years and we have tried to investigate if there is any connection between spouse's involvement and farm net income and family net income.

26.1 Introduction

The pilot project «The importance of partner involvement in farming» is a collaboration project among KUN (Centre for gender equality), Bygdeforsk (Centre for Rural Research, Norway) and NILF (Norwegian Agricultural Economics Research Institute). The aim of the project is to get knowledge on how involvement of spouses in farming influences economy, well-being for the whole family and recruitment for the farms. The project has an economic and a social dimension. NILF's part of the project was to study the economic dimension and the development over time.

Spouse involvement in farming has to be defined. There are many ways to be involved in farming, like participation in farm work, take part in decision making and support the farmer in different ways. It can be to involve the children in the farm work, take part in the management of the farm or support the farmer in administration. The different ways of involvement of the spouses are taken care of by the three participants in the project. NILFs contribution is the analysis of quantitative data of spouse's participation in farm work and farm economy.

26.2 Data Source and Methodology

NILFs part of the project has used FADN data from 1991 to 2010. The FADN data contain a lot of information on working hours on the farm. The participants in the annual survey register all their working hours weekly classified on person and activity. The different persons in this case are farmer, spouse, children, paid labor and unpaid labor outside the nuclear family.

The activities are classified in five different parts, agriculture, forestry, other gainful activities, other businesses outside the farm and employed work. The farmers also register own work on investments on the farm.

We have used the FADN data to make visible the development of working hours of the farmers and the spouses during the last twenty years. The average labor input is used to make the development visible. The development of working hours related to region, farm size and production is also presented.

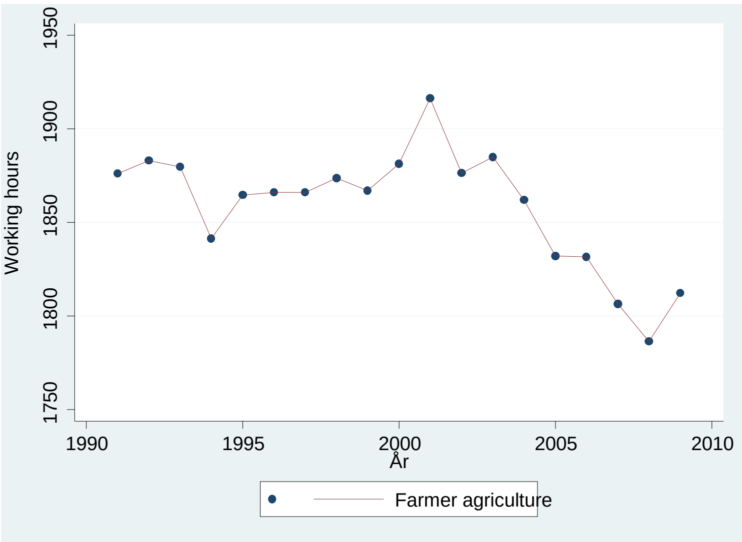
Simple regression analysis is used to study if there are any correlations between the spouse and the farmer's labor input and farm net income and family net income.

The farms without spouse are excluded from the project. About ten per cent of the farmers are excluded for that reason.

26.3 Results

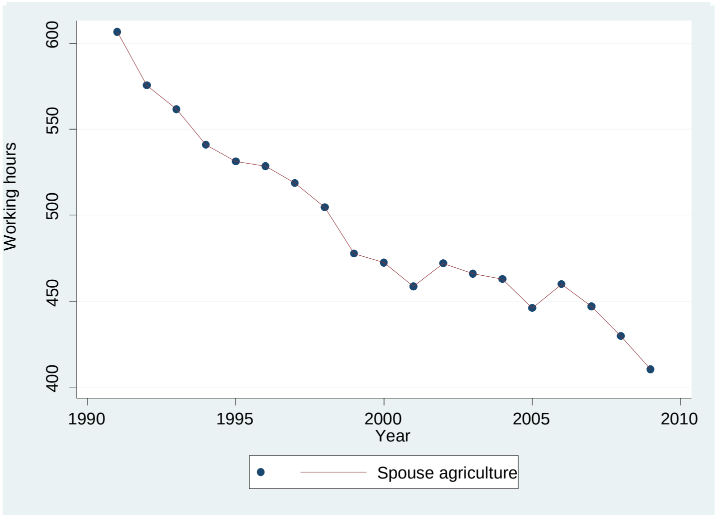
26.3.1 Working hours farmer and spouse - development from 1991 to 2010

Figure 1 Working hours farmer in agriculture 1991 to 2010



The average working hours for the farmer in agriculture from 1991 to 2010 has been quite stable through the period. The level is between 1800 and 1900 the whole period but there has been a decline the last decade with an exception for the last year.

Figure 2 Working hours spouse in agriculture 1991 to 2010



The figure shows an evident decline of spouse's working hours in agriculture during the period. The decline has been smooth the whole period from 607 working hours in 1991 to 412 working hours in 2010.

Figure 3 Working hours spouse relative to spouse in per cent

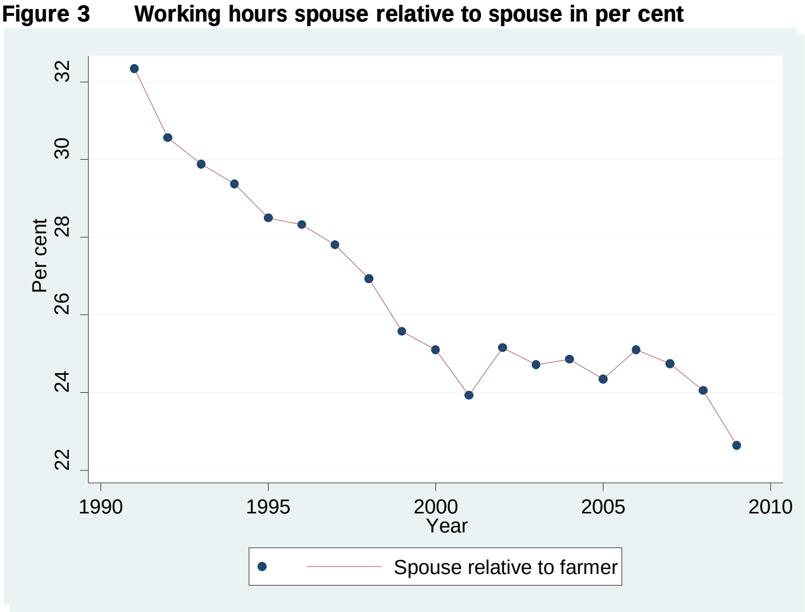


Figure 3 shows the relative labor input of the spouse to the farmer during the period. The contribution of the spouse has declined from one third in 1991 to one fifth in 2010.

Figure 4 **Working hours in agriculture of the spouse when the farmer is man or the farmer is a woman**

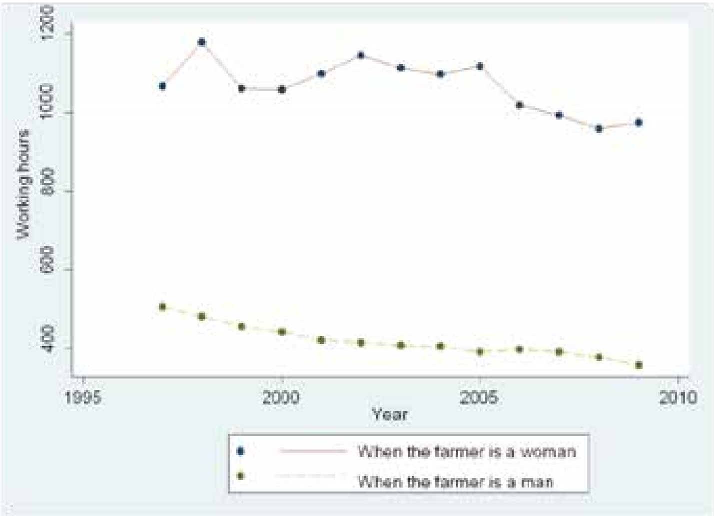
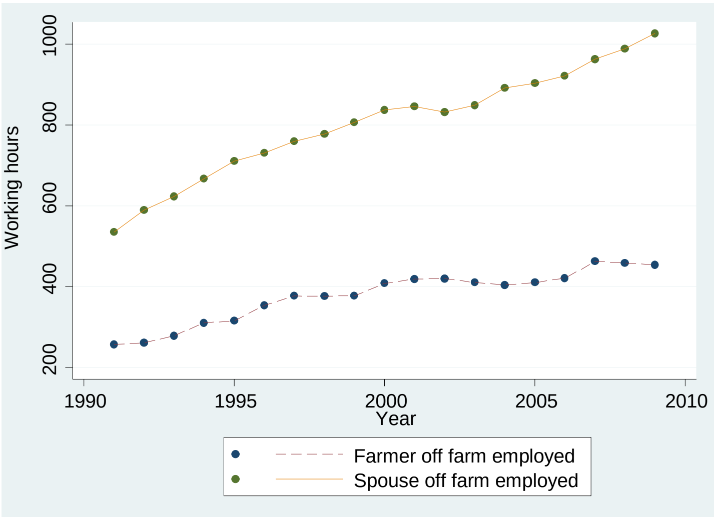


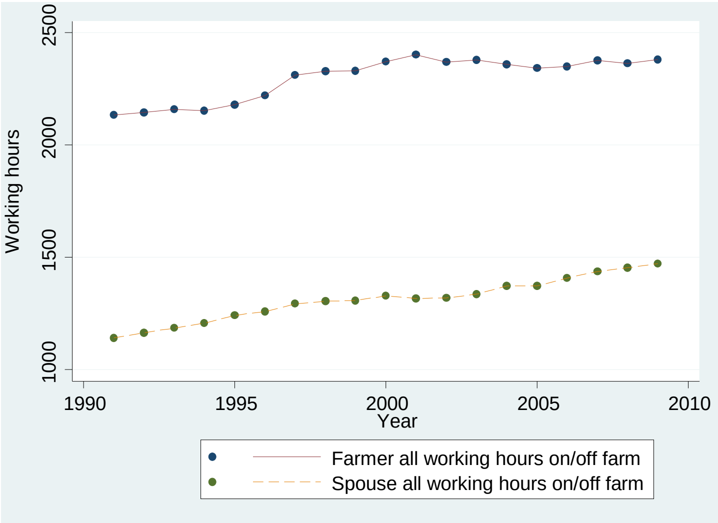
Figure 4 shows an interesting difference of working hours in agriculture when the farmer is a man and when she is a woman. In the FADN data 91 per cent of the farmers are men (2010). In cases the farmer is a woman, the average level of working hours of the spouse is much higher than the case where the farmer is a man. The difference is significant for the whole period and has been increasing the last years. The data set cannot explain the difference, but we assume the finding is caused by the distribution of work in the family where the woman has the main responsibility of house work.

Figure 5 **Working hours employed work spouse and farmer**



Both spouse and farmer have increased their working hours in employed work outside the farm during the period. The increase is largest for the spouse who has nearly doubled working hours from 526 in 1991 to 1026 hours in 2010. Employed work for the farmer has increased from 258 hours in 1991 to 454 hours in 2010.

Figure 5 Total working hours for spouse and farmer 1991 to 2010



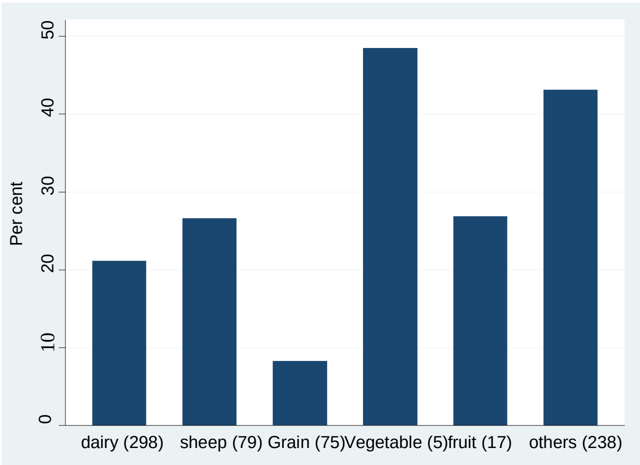
Combining the number of hours worked for both farmer and spouse in all activities, we see that both have had an increase in total hours worked from 1991 to 2009. The figure shows that while the curve for the farmer has leveled off after year 2000 to approximately 2300 hours annually, the curve for the spouse is still on the rise.

The analysis of trends over time shows that there have been major changes in the partner's involvement in the farm work from 1991 to 2009. Both the farmer and the spouse have reduced their effort on the farm and increased the number of hours spent on employed work, but it's for the spouse we see the most significant developments. This is probably related to that in the same period there has been an increase in the profitability of employed work compared to farming.

Total working hours for both spouse and spouse have increased from 1991 to 2010.

26.4 Present situation

Figure 6 Spouse's working hours relative to farmer in different productions in per cent



We have looked into the present situation to see if there are any differences in the spouse's involvement according to age, production, region and farm size. Data from 2010 is used to illustrate the present situation.

Working hours for the spouse is highest for vegetables and mixed productions and lowest for grain production. Labor input on grain farms is generally low with about 850 hours on average for all participants.

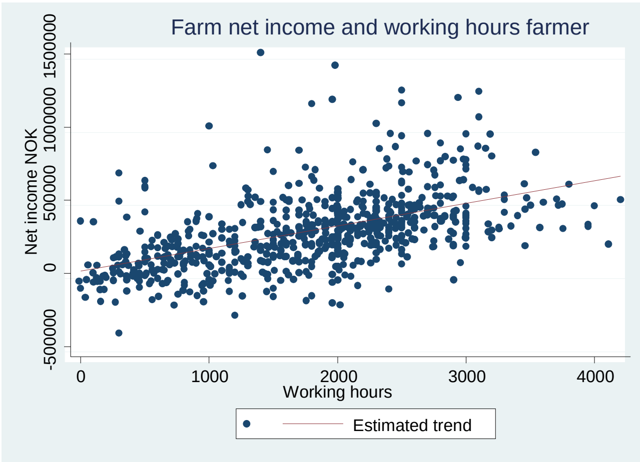
There were no differences in spouse's working hours related to age. We expected to find higher involvement among the oldest spouses, but the level was the same for all age groups.
We did not find any relationship between the spouse's working hours in agriculture and farm size. The farms were grouped by size of farm land (hectares), and the participation of the spouses in farm work was about the same in all groups. On the other hand working hours for the farmer were correlated to the farm size.

In Norway the country is divided into 8 regions mainly based on natural conditions for producing farm products. Grain production is located in the best climatic zones in the lowlands. Dairy farms are located in the grassland area all over the country. The analysis of the regions show results related to productions with most working hours for the spouse in regions with livestock farming and fewest working hours in regions dominated by grain production.

26.5 Effects on farm net income and family net income related to working hours of the spouse and the farmer

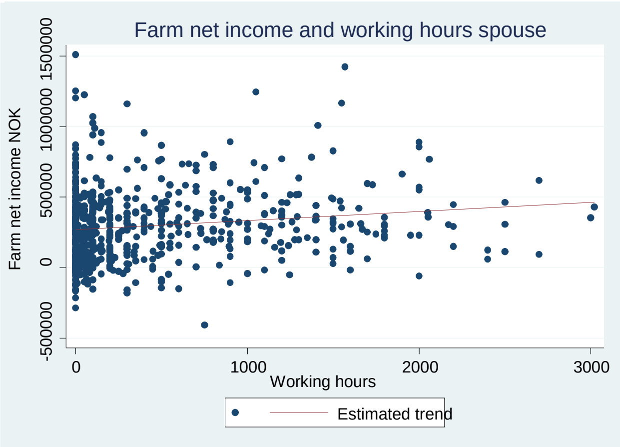
An important aim for this project was to study the effect on farm net income and family net income in relation to labor input from the spouse and the farmer.

Figure 7 Farm net income and working hours in agriculture farmer



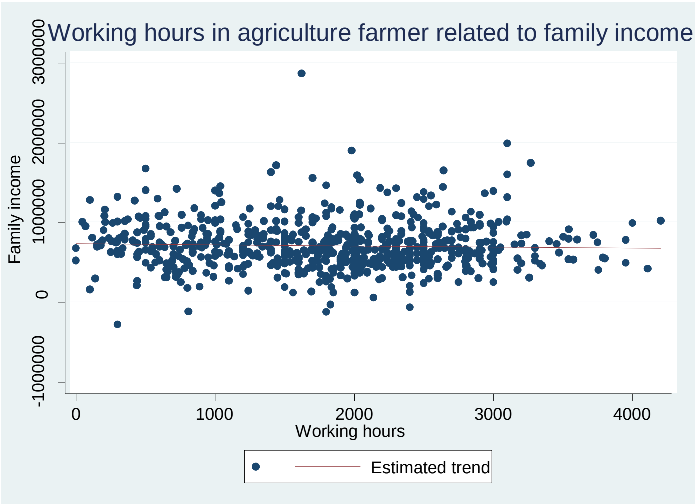
The figure shows a clear positive correlation between the number of hours spent by the farmer and farm net income.

Figure 8 **Farm net income and working hours in agriculture spouse**



The correlation between the number of hours spent by the spouse on the farm and farm net income is less clear for the spouse, although the custom curve shows a slight positive trend.

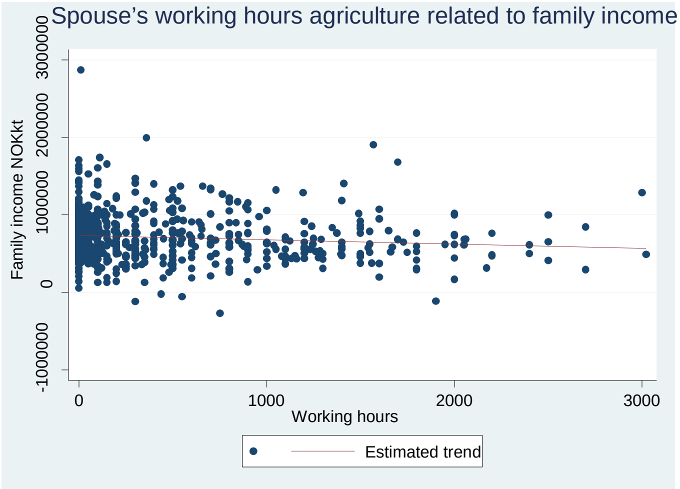
Figure 9 **Family net income and workings hours in agriculture farmer**



If we look at the correlation between the number of hours worked on the farm and family net income, and total income both on and off the farm, the correlation was slightly negative. This means that the more hours spent on the farm, the lower the family net income is. This relationship is strongest for the partner.

This negative correlation can be explained by the difference in profitability in different sectors. The profitability outside the farm is much higher than for agriculture.

Figure 10 Family net income and workings hours in agriculture spouse



The disadvantage of such a bitmap is that important factors such as the farm size and location are not controlled for. A regression analysis permits such control. These are statistical methods that estimate correlations between variables, and by means of these methods it is possible to say how the labor input affects economic profit, independent of other factors.

We start with a regression made of data collected in 2010 for the following model:

Farm net income = $\beta + pj + \beta_1 \beta_2 bj + ij + \beta_3 \beta_4 A + \gamma D + \delta R + \varepsilon$

The dependent variable is farm net income, and we will see how this is affected by pj which are spouse's labor input on the farm, bj is the farmer's working hours on the farm, ij is the number of hours of paid labor on the farm, A is area, D are dummy variables for pure productions measured against mixed productions, R is regional dummy, ε is the error term.

The results of the regression show that both the spouse, the farmer and paid labor has a positive, significant effect on farm net income. According to the analysis an hour of work from the spouse gives an increase in farm net income of 45,66 NOK, for the farmer this is 109,92 NOK while for paid labor it is 24,23 NOK. The low value of paid labor is because this implies salaries, which reduce income.

OLS regressions look only at 2010. If we instead use the entire data set back to 1991, we get a larger selection. If we use fixed effects regression, we also control for characteristics that most likely will not change over time. Examples are geographical and climatic conditions at the farm or farmer's level of education, work, etc. In such an analysis, we adjust the money amounts for inflation by using the consumer price index.

The results of this regression shows that the results are similar to those for 2010, but the difference in the effect of the spouse and the farmer's labor input is less: A working hour from spouse provides increased income of 37,90 NOK, while the farmer's labor input income increases by 47,70 NOK.

We repeat a similar analysis to see which factors affect family net income of farms in Norway, here defined on the total income from all sources minus paid interests. We use the same model as before, but add two variables: pl spouse's working hours employed work and bl for farmer's working hours in employed work.

Family net income = $\beta + \beta〖〗_1 pj + \beta_2 bj + ij + \beta_3 \beta_4 pl + \beta_5 bl + \beta_6 A + \gamma D + \delta R + \varepsilon$

The results of OLS for 2010 show that neither the spouse's nor the farmer's working hours on the farm has any significant effect on family net income, while the paid labor has a positive effect. However, the analysis shows that the spouse's employed work increases income of 148 NOK, the equivalent of farmer is 95 NOK.

Then we conduct the same regression with the entire panel and fixed effects. The results show that both spouse's and farmer's working hours on the farm leads to reduced family net income, respectively, 0,20 and 21,70 NOK, but the result is not significant for the spouse. This result is somewhat surprising, since we have controlled for income from employed work. But the reason may be reverse causality, that in times of recession and low wages, the farmers spend more time on the farm. For paid labor the is effect positive and 51,30 NOK respectively. Reversed causality may be the cause, meaning that farms with high family net income use more paid labor. As expected employed work has a positive effect on family net income, this amounts to 80,70 NOK for the spouse and 71,80 for the farmer.

Regression analysis shows that spouses working hours on the farm has a positive effect on farm net income, while the effect is non-significant or negative on the family net income, even when controlling for wages.

26.6 Conclusion

Through the analysis of FADN data, we have made the following findings:

- Spouses participate with most working hours in mixed farms, vegetable farms and livestock farms, fewest hours in grain production.
- Working hours increase with farm size for the farmer, this does not apply for the spouse.
- There are small regional differences in the spouses' involvement in farm work
- Female farmers have more participation of spouse than male.
- Working hours of farmer and spouse in agriculture has declined over time, most for spouse.
- The difference in profitability of employed work and farming has more than quadrupled since 1991.
- Number of working hours in employed work has increased over time, most for the spouse.
- Both farmer and spouse have more working hours in total in 2010 than in 1991, the largest increase for the spouse.
- Spouse's involvement in farming is positive for farm net income, but has no detectable effect on family net income

In our study we only looked at the direct economic impact of the spouse's involvement in agriculture as measured by the number of working hours and farm net income or family net income. Within the framework of this project it has only been room for relatively simple analysis, while a more thorough treatment of the material might leave some insight. For example, you could put various groups against each other, compare with farms without a spouse, use other financial measures such as output per hour worked.

26.7 References

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27 Exploring agricultural data using self-organizing maps

A Mika Sulkuva

27.1 Introduction

Profitability of farm enterprises is very important, because it makes it possible for the farms to stay in the business in the long run and thus, be a part of stable food supply chain. For example, farm profitability in Finland has been fluctuating rather vigorously during the recent years [1]. This may complicate the farmers' planning of the future.

In this paper, the use of self-organizing map (SOM) is presented for analyzing financial data of agricultural and horticultural enterprises. The data is collected from a sample of bookkeeping farms. This data is a source of many figures characterizing Finnish agriculture in the EconomyDoctor service of Agri- food Research Finland [2]. The goal of the SOM-based approach is to discover interesting interrelations between financial variables in the data.

The SOM has been successfully used in financial analysis, e.g., benchmarking of industrial companies [3]. A SOM-analysis of the relationships within book- keeping farm data will be published at the end of 2012 [4]. The data has been analyzed with the aim of understanding input substitution and technological development of farms [5] and finding changes in productivity [6, 7]. In addition, neural networks have been used in predicting the sufficiency of internal financing of farms [8].

The organization of the rest of the paper is as follows: in the next section we present the data, in Section 3 the SOM and related parameters are explained, the results are shown in Section 4, and conclusions drawn in Section 5.

27.2 Profitability bookkeeping data

Annual profitability figures for Finnish agricultural and horticultural enterprises showing the average results of over 60 000 enterprises are calculated from the profitability bookkeeping organized by MTT Agrifood Research Finland. Profitability of Finnish farms is monitored using a sample of approximately 1 000 farms yearly. Data from year 2010 is used in this study. In 2010 there were 940 bookkeeping farms. The original aim has been to represent the 40 000 largest enterprises of Finland. Therefore, the sample still contains only a few small farms.

The form of bookkeeping data is similar to the data in the Farm Accountancy Data Network (FADN) [9]. There are thousands of variables in the bookkeeping data bank. An expert selected the variables used in this study. The aim was to select variables that have potential of providing a diverse picture of the economic performance - especially solvency and profitability - of farm enterprises.

In this example, the following variables are used to characterize each book- keeping farm i: economic size e_i, utilized arable area a_i, livestock units, profitability ratio, and debt-%. Wage cost of own labor in 2010 is calculated using hourly wage claim of 14 e. The interest cost on equity is calculated on the basis of a farmwise interest rate, which is the sum of risk-free interest rate and a farm- wise risk premium. When the compensations of labor input and own capital are deducted from entrepreneurial income, we obtain the entrepreneurial profit. The profitability ratio is defined as $E/(W+I)$, where E is the entrepreneurial income and W and I are the wage and interest claims, respectively [10]. When the profitability ratio is 1, all production costs have been covered and the en- trepreneur's profit is zero [2].

Areas are reported in ha in the data and the currency unit is €. Livestock units are defined as grazing equivalents of dairy cows, i.e., small animals count for less than one livestock unit. See [11, 2, 8] for more information on calculation of financial variables.

27.3 Self-organizing map

The self-organizing map (SOM) [12] is a useful tool in exploratory data analysis. It projects multidimensional data into a low-dimensional grid, which is easy to visualize. The SOM has been used successfully in numerous applications [13, 14].

The SOM consists of a regular, usually two-dimensional, grid of map units. Each unit i on the two-dimensional grid also has a d-dimensional prototype vector m_i, where d is the dimension of the observations x_j, $j = 1, \ldots, n$. Thus, the SOM defines a nonlinear projection from the d-dimensional data space to the two-dimensional grid. The SOM is trained to represent the original data by adapting its prototype vectors according to the distribution of the data set. The observations are mapped to map units with the closest prototype vector (the best-matching unit). Thus, in addition to nonlinear projection, the SOM also performs vector quantization. This representation can be used for visualization, clustering, and exploration of data [12].

Before training, the number of map units and the structure of the grid in the SOM are defined. The dimension of the prototype vectors is determined by the dimension of the data set. After initializing the map randomly or along the two greatest eigenvectors of the data, the training proceeds iteratively. At each training step t an observation x_j is first mapped to a map unit by looking for the best-matching unit c_j using a Euclidean distance measure between the observation and the set of map units.

$$c_j = \arg\min_i \|x_j - m_i(t)\| \qquad (1)$$

Second, the prototype vectors are adapted to better represent the distribution of the data

$$m_i(t+1) = m_i(t) + \alpha(t) h_{c_j,i}(t)\,[x_j - m_i(t)]\,, \qquad (2)$$

where $\alpha(t)$ is a learning-rate factor and $h_{c_j,i}(t)$ is the neighborhood function. It is often a Gaussian function - also in this study

$$h_{c_j,i}(t) = \exp\left(\frac{\|r_{c_j} - r_i\|}{2\sigma^2(t)}\right), \qquad (3)$$

where r_i is the location of the map unit i on the grid and $\sigma(t)$ corresponds to the width of the Gaussian function. Both $\alpha(t)$ and $\sigma(t)$ decrease during training. The original sequential training algorithm adapts the prototype vectors after each observation, whereas the batch training algorithm adapts the prototype vectors after all the data have been gone through [12].

The map units are connected to neighboring units on the grid by the neigh- borhood function. Therefore, the mapping from the original data space to the two-dimensional grid tends to preserve topological relationships. This means that observations close to each other in the data space tend to map to the same or close-by map units in the grid. Without the neighborhood function the SOM algorithm reduces to k-means clustering algorithm [12].

Conceptually, the SOM and its map units form an elastic net in the data space. This makes visualization of the grid useful in exploring the relationships of variables and the possible cluster structure of the data. The map can be visualized using component planes, each of which shows the values of one of the original d variables as colors on the grid. In addition, the map can be visualized with the unified distance matrix (U-matrix) [15], which shows the within-unit distances and distances between neighboring units on the grid.

Training and analyzing the SOM was performed in this study with the SOM Toolbox for Matlab [16]. Before training, the number of map units and the structure of the grid in the SOM are defined. The number of map units was chosen based on the default setting of SOM Toolbox, i.e., 5 sqrt (N). We used hexagonal grid sheet structure and the default ratio of the side lengths: $\mathrm{sqrt}(\lambda_1/\lambda_2)$ where λ_1 and λ_2 are the two largest eigenvalues of the autocorrelation matrix.

The observations were normalized linearly before training, e.g., so that the mean of each variable is 0 and the variance is 1. The method used to normalize the data defines the distance between multidimensional vectors. For example, how should a change in debt percentage be related to a change in utilized area measured in hectares. Normalizing all the variances to unity solves this problem by defining that changes in different variables are equal if they are in equal proportion to their standard deviations. As a result, all variables have equal weights in this sense.

The map can be visualized using component planes, each of which shows the values of one of the original variables as colors on the grid. In addition, the map can be visualized with the unified distance matrix (U-matrix) [15], which shows the within-unit distances and distances between neighboring units on the grid.

27.4 Results

An economic map of the bookkeeping farms was produced with the SOM. The U-matrix and component planes of the SOM are show in Figure 1. The U- matrix suggests that there may be cluster structure in the data, but the possible cluster boundaries are not very sharp. However, farms characterized by extreme conditions can be found separated from other farms in both top and bottom left corners of the map as well as in the middle of the left border.

Different economic types of farms can easily be spotted using the map. The top left corner corresponds to the largest farms with the highest utilized arable areas, and the most livestock. The profitability of these farms is average, mainly below 1. The debt-% of these farms is rather low.

The top right corner of the SOM represents large farms with little utilized arable area and few livestock units. Similar to the previous group of farms, the profitability is average and debt-% low.

The farms with the highest utilized arable areas are in two locations in the top part of the map. High utilized arable area has no clear connection to the other variables studied in this paper.

In the mid-left part of the map there are economically small farms with aver- age utilized area and small amount of livestock. These farms are not profitable, since the profitability ratio is typically negative. The debt-% of these farms is the highest.

The bottom left corner of the SOM also has low-profitability farms. They are small farms in the sense of economic size, utilized arable area, and livestock units. They have the rather low debt-percentages.

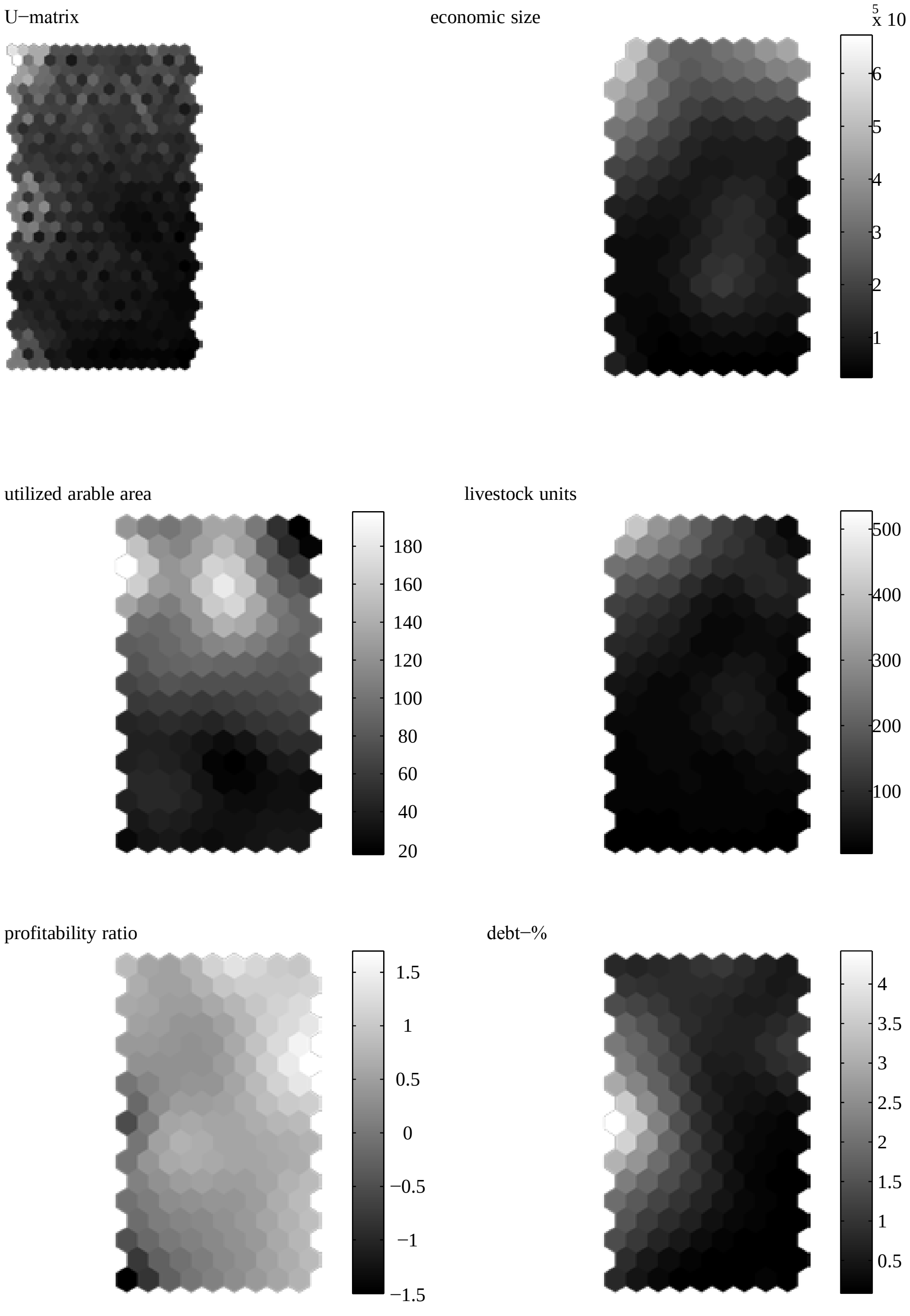
The other farms falling between the areas of the SOM described above have intermediate properties with respect to the measured variables. Thus, the distributions of the five variables and interconnections between them can be easily seen in the figure.

27.5 Conclusions

Using self-organizing map makes it possible to analyze effectively interconnections between the variables characterizing the performance of agricultural en- terprises. In the example case of Finland, different kinds of farming could be easily distinguished on the map.

We studied four groups of farms with different profiles of size of operation, profitability, and debt. Consequently, we came up with the following hypotheses concerning financial status of Finnish farm enterprises. 1. Large economic size does not necessarily result in high profitability. 2. Farms with the highest debt- % have very low profitability. 3. Economically small farms with little utilized arable area and few livestock units also have very low profitability. 4. High profitability is not connected to extreme values in economic size, utilized arable area, livestock units, or debt-%. Analysis of the hypotheses above - as, e.g., in [17], cluster structure in the data, and temporal behavior of farm profitability are left as subjects for future research.

Figure 1 U-matrix and component planes of the SOM trained with farm book- keeping data



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28 Farm profile - system for improving management and farm database

Vesna Ilievska, Borje Dernulf, Zoran Bardakoski, Zhaneta Ilievska

28.1 Introduction

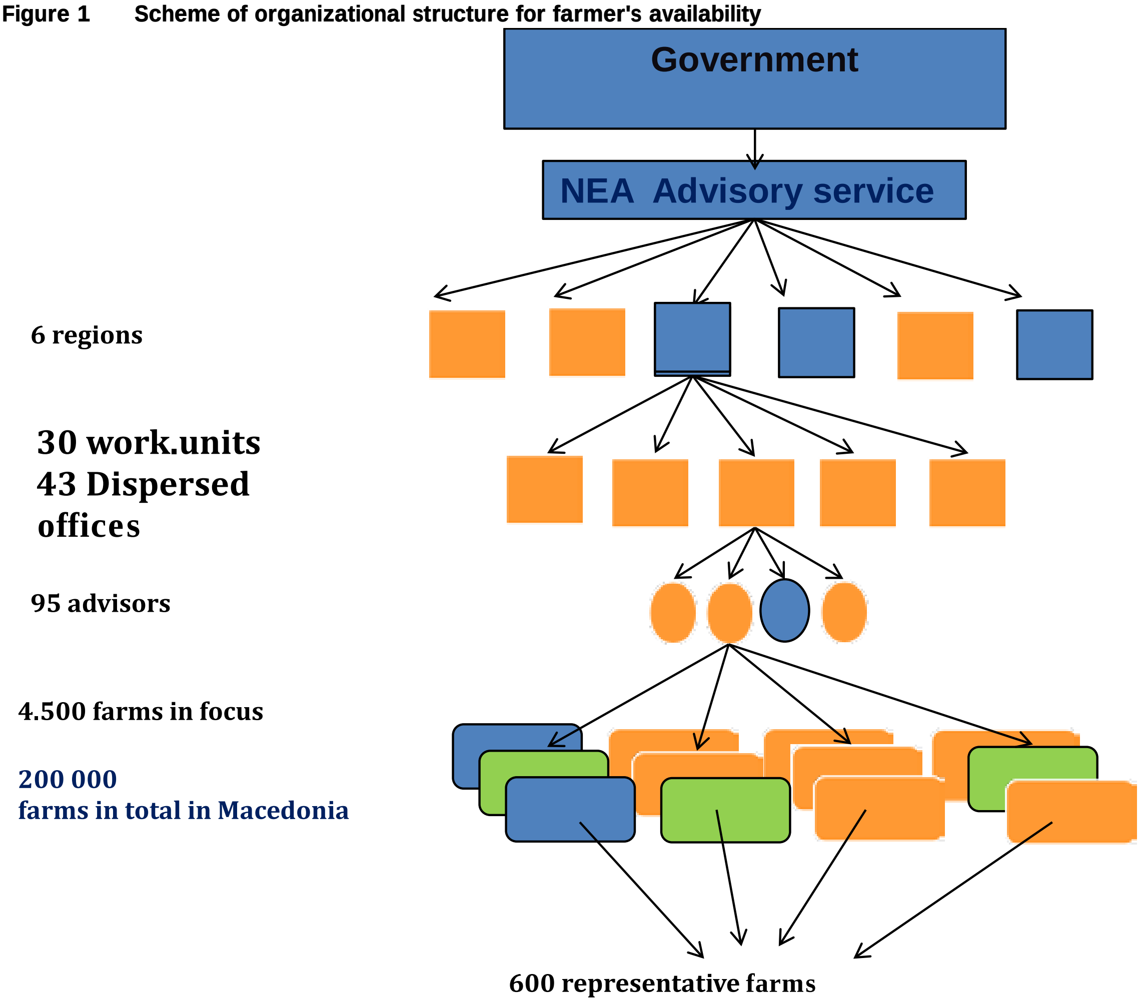
This paper aims to show the integration of recent developing activities based on existing conditions and needs in the efficient functioning of the NEA, which improves database for farmers. Thus created a database of direct and indirect data arising on a farm and farm environment, are a precondition for creative user and multipurpose analysis available for practical application to the farmers.Organizational structure of the NEA for farmer's availability.

28.2 Organizational structure of the NEA for farmer's availability

NEA was established by Law, with support from the World Bank project, in accordance with the Agricultural Development Strategy of the Republic of Macedonia. With the implementation of the reform, NEA aims to enable the transfer of knowledge and information and their implementation in agricultural holdings (farms) to improve the quality and quantity of agricultural production with economic viability, competitiveness of Macedonian markets in EU, sustainable development of agriculture in rural areas, and support the development and implementation of agricultural policy by maintaining a database of farms through field visits on the farms.

Established organizational structure in NEA, enables a combination of centralized decentralization with autonomy in decision making in the planning process and implementation of activities on the field, with the ability to monitor and evaluate the results of the activities according to the relevant indicators of success, applied on several hierarchical levels and implementation of mandated becoming more 'bottom - up'.
'

Figure 1 Scheme of organizational structure for farmer's availability



28.3 Communication and relationships between the advisor and the farmer

NEA is responsible for providing high quality expertise advisory support on the field to the farmers in order to improve the quality, quantity, and profitability of agricultural production with the introduction of economic and management skills, and optimization in the use of available resources in rural areas, supporting the government's development programs in agricultural production. For successful implementation of the objectives, it is necessary availability of additional realistic field data, whose quality depends very much on the established communication between NEA advisors and farmers.

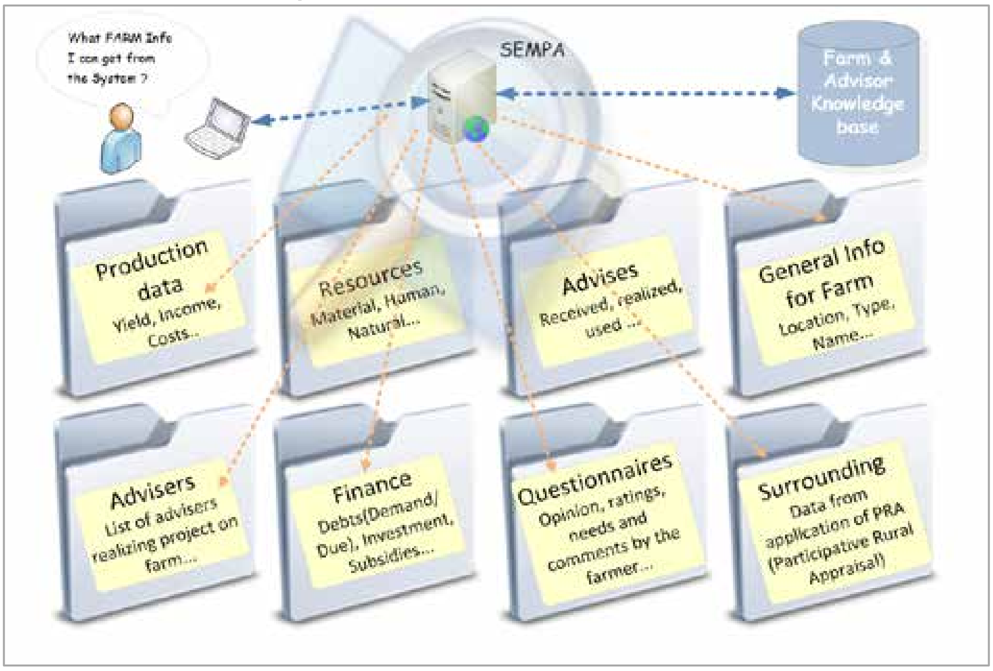
- Continued communication between NEA Advisors and farmers, is based on:
  Mutual long-term cooperation with advisors
- Mutual trust,
- Realization of common goals,
- Continuing motivation for the development of the farm business
- Recognition of clear and achievable indicators of success etc.

Profile farm sub-system incorporates all kinds of data resulting from established communication.

Table 1 Record of the data from the established cooperation contained in Farm profile

Record of the data from the established cooperation contained in Farm profile		
· Basic data for the farmer - Personal data · Basic data for the farm - Location - Staff - Family · Resources on the farm - Human - Material - Natural · Business Data - Cost of production - Yields - Incomes - Inventories (stock) - Workforce - Investments - Other data	· Implemented advisory services - Training - Technical advisory economic packages - Education - Informing - Demonstrative trials · Advisors - Consultants farm - By specialty - Territoriality (region, municipality, community) · Data for certificates for successfully completed training for farmers - Made analyzes and reports for the farm - Production - Costs (farm, product) - Comparative analysis with other farms - Resources - Calculations and others. - Submitted advisory services - Submitted recommendations, suggestions - Implemented techniques, technologies, knowledge, skills	· Data for state support - Subsidies - Donations - IPARD - National programs · Data for the environment (data obtained under PRA method) - Used / Unused Resources § Human § Material § Natural · Data infrastructure - Road network - Access to market - Access to water - Irrigation System - Health services · Surveys - Satisfaction of users - Needs and requirements of farmers - Opinion of Advisors - Proposals and suggestions from the community

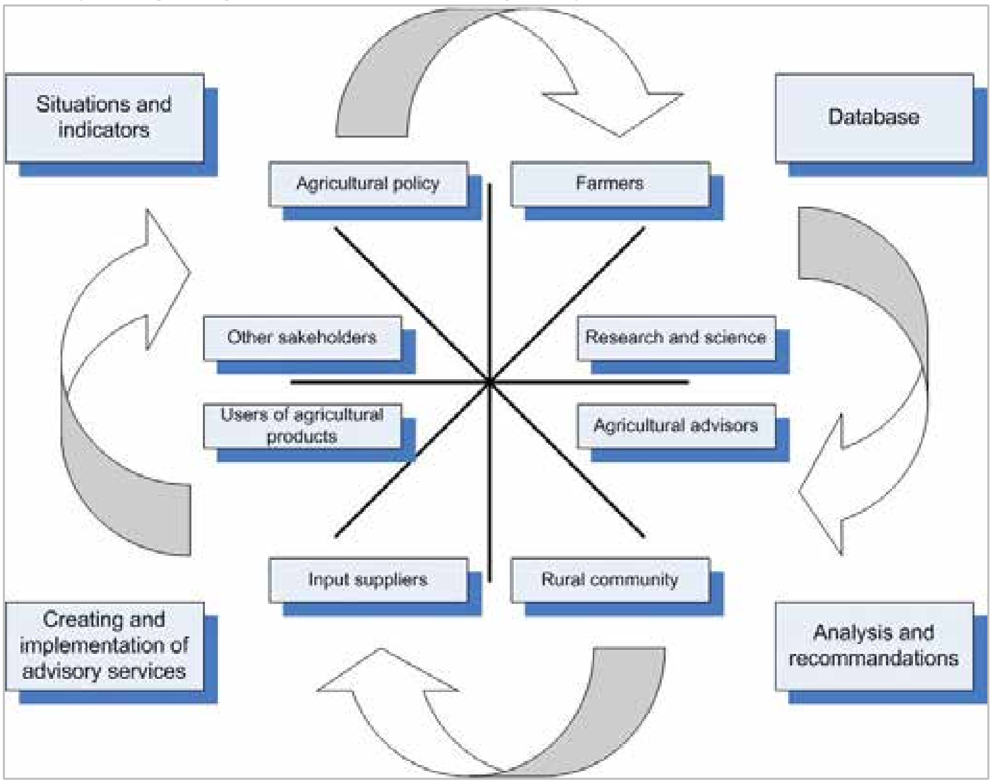
Figure 2 Data sets in the Farm profile



28.4 Cycle of stakeholder participation in maintenance of the sub-system Farm profile

Each subsequent cycle affect the outcome intended for participants in the cycle as a motive more for their participation in the cycle and building farm profile.

Figure 3 Cycle of participation of stakeholders in updating the database



28.5 Integration of existing subsystems

Integrating existing subsystems in the system Farm profile set up a database that covers the following subsystems: SEMPA, PRA, FMS/FADN, FAM, SMS

28.5.1 SEMPA - Subsystem for evidence, monitoring and planning activities of the NEA advisors

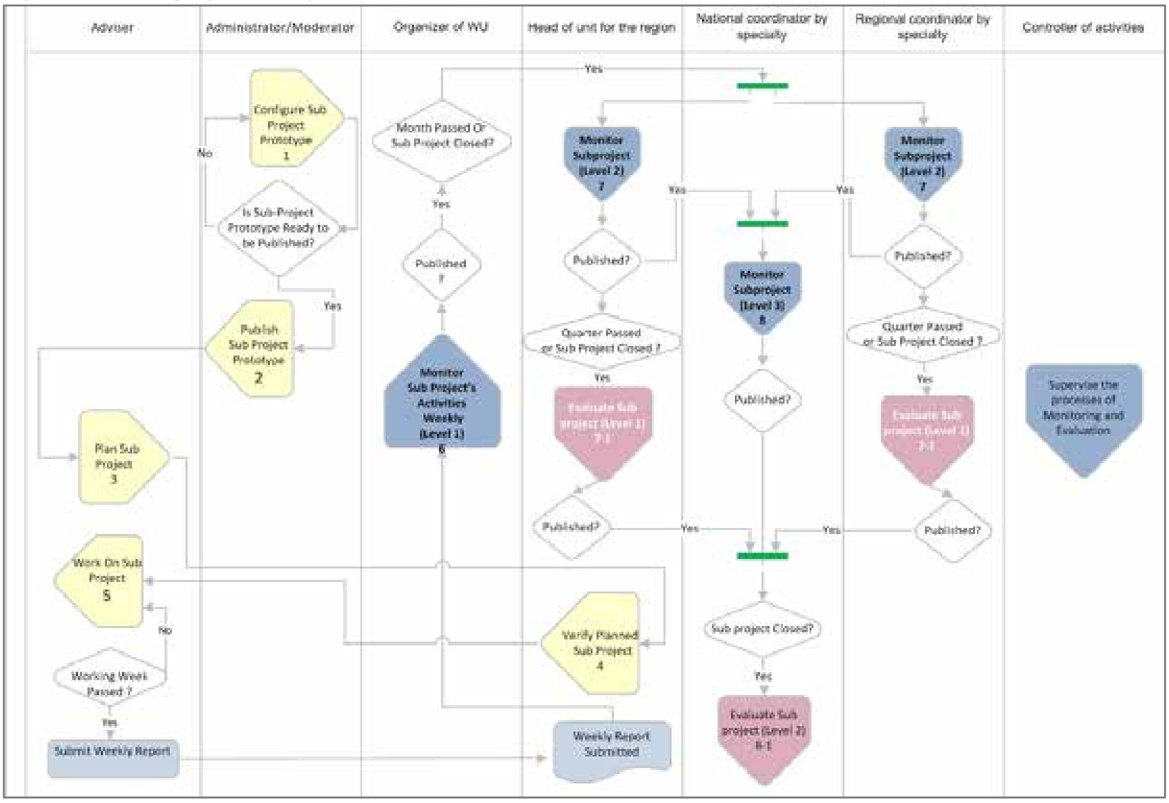
In order to increase efficiency and effectiveness in the realization of annual working plans, SEMPA system is implemented in NEA. System defines concrete projects and sub-projects related to specific employees, customers, the claimant of services, needed resources, used procedures and instructions, time records of the assignments and conditions of the project entries (lists, photos, etc.). Overall activity is monitored and assesses according to performance indicators at different levels of access and responsibilities. Consequently, opinion and customer satisfaction for services is recorded.

One strategic approach towards this objective is implementing a software solution. On a higher level, the solution is a tool that:

- Speed ups the process of establishing more efficient organizational and working procedures
- Alleviates the implementation of the immature processes that are in the early beginning
- Provides better control over established working processes as well as decentralized approach in coordination, control and implementation of working activities.
- Supports the determination of the strategic plans, annual working plans, as well as finances, based on concrete parameters of activities with indicators of success and evaluation.
- Replaces the hard copy evidence of some processes and thus alleviate the process of reporting and decision making on a higher levels.
- Facilitates the process of determination of the NEA's services real costs as a step toward improvement of the NEA's services.

All subsystems are part of the hierarchical levels of access to the system SEMPA.

Figure 4 Subproject life cycle



28.5.2 PRA - Subsystem for Participative rural appraisal

Represents Assesment of rural areas with the participation of residents themselves. It's an approach that includes a variety of participatory techniques and tools for collecting data that allow stakeholders to analyze their problems and then plan, implement and evaluate progress and success of the agreed solutions. PRA is a fundamental activity that is regular work obligation and duty of every advisor for diagnosing problems and finding a solution with the participation of people in rural areas.

It consists of two activities: implementation and analysis. The implementation is done by collecting data on the field in rural settlements, while the analysis is performed in office. Data are collected and analyzed using a set of tools that allow representation of reality in a different form of reports. PRA consists of the following tools:

- Mapping;
- Seasonal calendars;
- Conversations with key informants;
- Transect - Tour Information;
- Time diagram of the community;
- Focus groups.

The purpose of this activity is participatory collection of physical, socio-economic and agro-economic information of the population living in rural areas, information that further benefit employees in NEA of making programs, planning and management, as well as managing the work programs in dispersed offices. This activity represents the auxiliary tool of the advisors in NEA in the preparation of detailed analysis of agricultural knowledge and information systems within each dispersed office. This is achieved through the implementation of a participatory approach to collecting data sharing with the local population.

28.5.3 FMS/FADN - Subsystem for farm monitoring/Farm accountancy data network

Supports ongoing activity of each advisor in NEA, its importance is accentuated by Law for establishing a farm accountancy data network from agricultural econimies (Official Gazette No.110/07). For successful implementation of the activity are defined forms for data collection, built IT software, manuals for collecting and input data into the system, defined programme with approved budget. This activity includes at least 600 farms with records of their basic data, available resources, proceeds, revenues, expenses, labor, investments, other income and so on.

The system provides records for representative and non representative samples of the Macedonian farms. The data have multy user approach:

- FMS is a tool for development of the advisory service
- Represents a basis for handling updated database of the farms
- Provides opportunities for analysis, research and so on
- Linking physical and economic parameters in the business of farm as a condition for development of profitability of the farm
- The database is used nationwide, FADN, statistics, insurance companies, banks, donors, research activities etc..

The basis for successful FMS/FADN activity is good cooperation and trust between the farmer and the advisor, the expertise of advisors, collection and processing of timely and accurate data, compatible multi user IS software, uninterrupted flow of information between the farmer-advisor, implementation of modern and quality services on the farm and primarily responsible approach of the advisors to this activity.

28.5.4 FAM - subsystem for analysis and farm monitoring

NEA's core business is providing advisory packages for farms which cooperate with NEA. The advisory packages are products/services of NEA which are being prepared in order to improve the quality of the farm's products and thus to increase the farm's productivity. The advisory packages are prepared by NEA experts, based on the current state of production in a particular farm or farms, respectively, but based on data collected on the field as well.

Based on data collected from the field, NEA experts conduct analysis and propose measures translated into advisory packages.

Farm's data are used for many purposes. Through further processing, they might be used to assess the state of production by region, for different products of crop or livestock origin and like. These analyzes are carried out for the needs of the various institutions that cooperate with NEA and their purpose is for planning and setting the strategies on macroeconomic level.

Based on the above, accuracy, timeliness and quality of data collected on farm, directly affects the quality of the work and the results of many entities involved, ranging from farm, advisors, NEA as a whole and all external entities that cooperate with NEA. In other words, the processes of these entities along with the related results of operations are mutually connected in a cycle.

Currently, data on farms that are collected and processed in NEA's information system, are grouped into three main areas:

- Data related with planned and implemented activities by the Adviser while implementing of advisory services for farm, including the necessary resources, material costs, equipment and other inputs that are necessary for their activities - Modules of SEMPA system - Administration, Recording of activities, Evaluation and Monitoring
- Data related to farm resources and finance

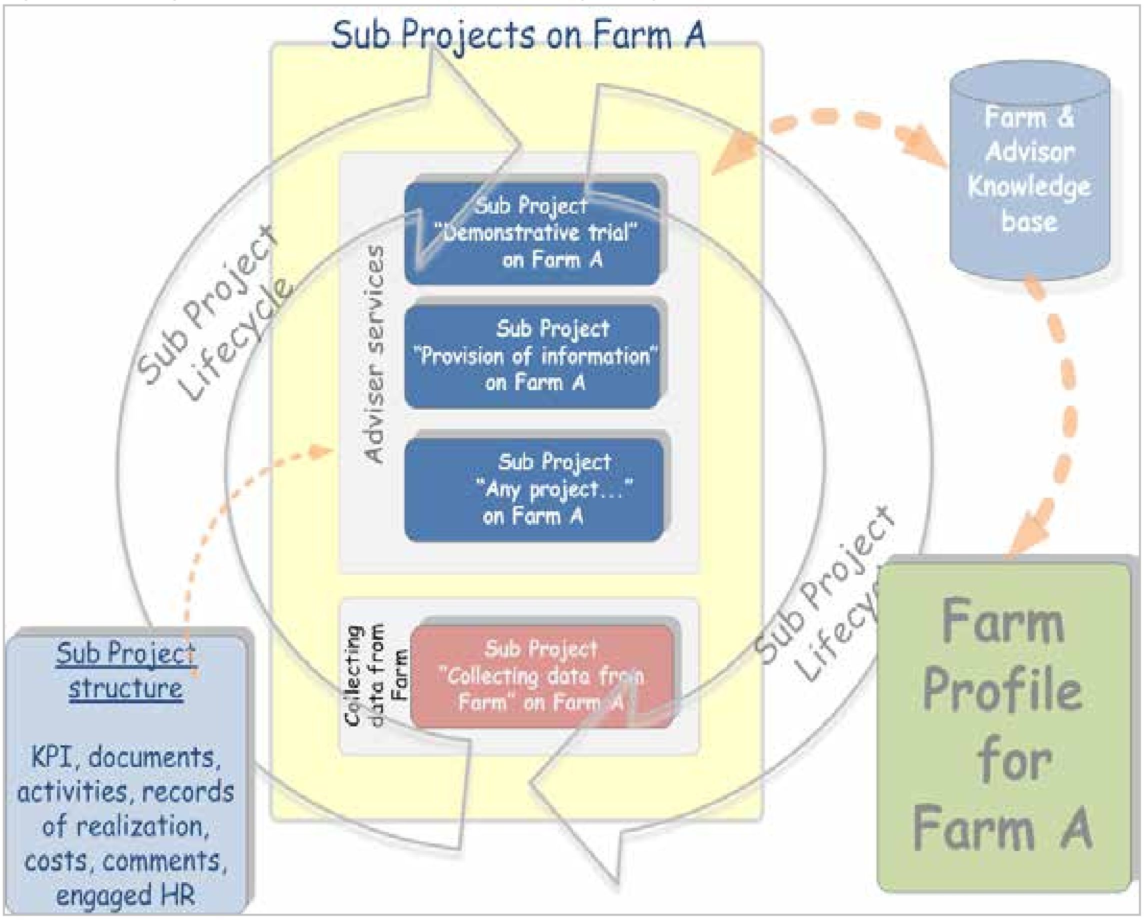
- Integrated data for Farm and advices on that Farm.

The software solution provides a straightforward and intuitive way of entering and updating data on the farmer. By integrating of the data for advice and data from the farm, a smooth flow of information in the cycle processes that include farmers, advisors and NEA as the main entities in the process, is achieved. This subsystem incorporates and controls for data quality and allows external and internal data user approach, applying the principle of protection of personal data.

Integration of the controls on data entry and controls after the final entry, are by using the definitions and needs of national and FADN aspect.

To summarize, the purpose of the FAM subsystem is obtaining efficient, an accurate and better data entry quality in general. It helps the advisers to analyze and manage more accurately data and to rely on data with a better quality. In turn, this helps NEA in implementation of its own policy and in decision making on micro and on macro level on time and efficiency.

Figure 5 Diagram for Derived Farm Profile thru Projects cycles



28.6 Application of new technologies for data collection and their integration in the system

28.6.1 Mobile application for farmer data entry 'in situ' (Using PC tablet)

When Advisor is preparing for work on field, it is necessary to take the file for farmer(s) to be visited, with all the records for that farmer(s) currently at NEA. It is also necessary to prepare additional documents for entry of new data related to the farm to be visited, and which have not been already introduced in the information system of NEA. Similar is the procedure when visiting and making an agreement with a new farmer. The Advisor needs to bring all blank forms/documents that are filled out on the field in order to be included into the farmer's file.

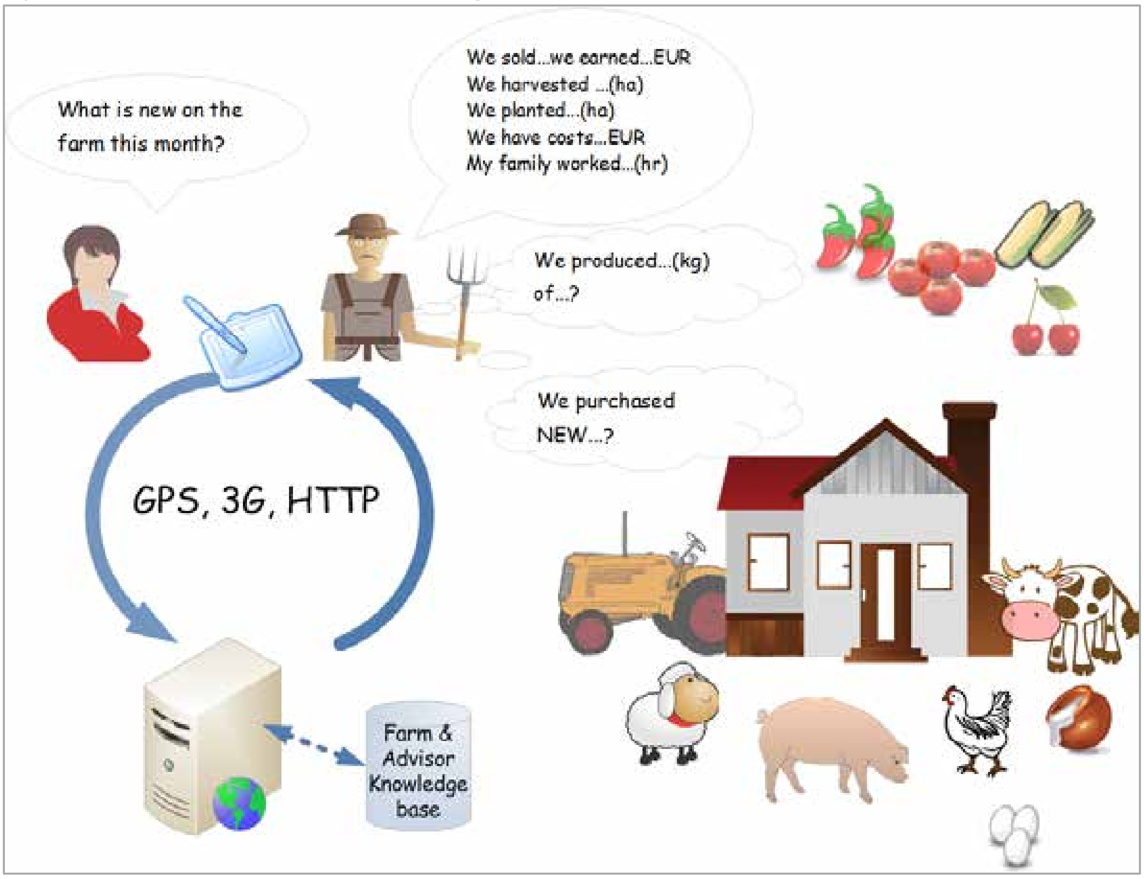
This process does not end here because the next step is to convert documents into electronic form i.e. to be entered into the system. The updating of such documents should be done manually during the entire operation of the farm which collaborates with NEA.

According to the above described two-phase process for farm's data collection: in paper format (while the adviser is on the field) and then input of the data into the system, as a second phase, in direction for improvement and optimization of the procedure, in NEA is developed an portable application that (mobile application, designed for work on field). By use of the mobile application on the field, double entry/update of farm's data (first on paper and then in electronic form) is avoided. Recorded field data on the mobile devices is automatically transferred to a central location in NEA's Central Database.

The benefits of using a mobile device application are multiple. Namely, while realizing the activities for collecting data for farm, the Adviser uses the application to take the info about the farmer(s) with whom plans to work at a particular visit. Accordingly, by using of the mobile device, one step of the current process is saved and avoided., i.e. there are no more need for manual paper data entry and entering the paper data into the electronic system. In addition, with the new approach, the process becomes more transparent, i.e. the Farmer can directly follow and influence the activity of recording the related Farm information into the mobile device, i.e. the NEA information system.

In general, the functionalities provided with the mobile application, provide a permanent, stable, simple and fast input/change of the farmer's data while the Adviser works on the field. This results in further improvement and enhancement of the quality of services provided by NEA for farmers.

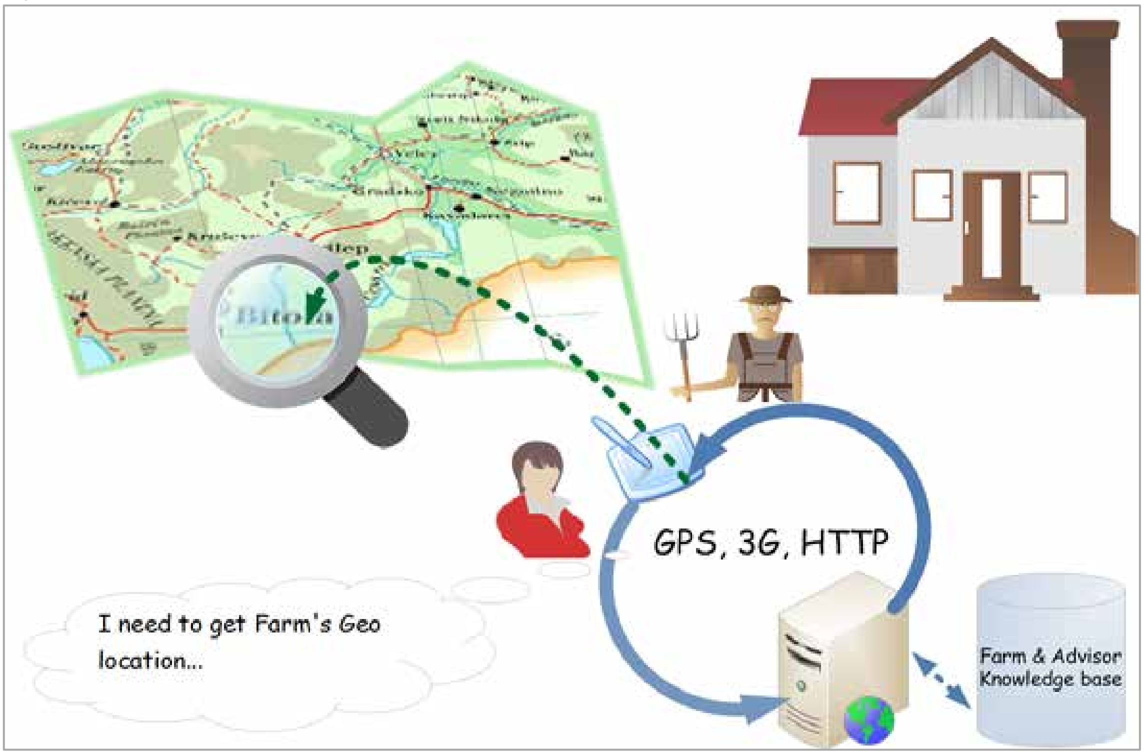
Figure 6 Tablet PC data Collection in the process



It should be emphasized that the mobile application offers new opportunities. Besides the above functionalities for data entry for farm according to the prescribed form by NEA, the mobile application and the mobile device provides as well:

- *Automatically retrieving of the location of the farm with the help of GPS coordinates*
  When using the functionality for automatically retrieve the location of the farm, the map of Republic of Macedonia along with the farm location can be displayed on the mobile device, by using geo-location services. Later, these data could be analyzed in the web application through a visual display of aggregated data for farms on the map, by using different criteria that are of interest for the analyzes.

Figure 7 Farm Geo location



The following criteria for filtering and presenting farms can be set in the web application: by region, municipality, type of farm, culture/crop, reared livestock on appropriate farm and on the map of the Republic of Macedonia can be displayed, visually all farms (according to their geo-coordinates) that satisfy the previously selected criteria.

- **Taking pictures on the farm.** While on the field, an adviser is able to make a gallery of photos from the farm, which will then be entered into the farmer's record for later observations and analyze.
- **Input of the electronic signature of the** farmer (confirming the validity of the collected 'in situ' data).
- **Assent of the Farmer.** The assent of the farmer that his/her data might be used by NEA, currently is verified with his/her signature within the appropriate documents for compliance, in electronic form. With the mobile application, the signature can be provided directly on the mobile device (tablets).

28.6.2 SMS info

One of the primary objectives of NEA is to encourage the development of agriculture and thus the maximum support in the development of the farmers with whom it have a permanent cooperation. Activities conducted by NEA are of a different nature, and primarily consulting.

In this regard, informing to maintain various educational meetings and conferences is one part of the spectrum of activities of the organizational character. Especially important is the effectiveness and efficiency of the process of informing, which includes informing of a preventive nature which usually is of mass character.

The latter is the motivation for automation of the process for informing by implementing a Web-based management solution for sending bulk SMS messages to one or more farmers who cooperate with NEA as part of an integrated solution for recording the activities of the NEA employees - SMS module.

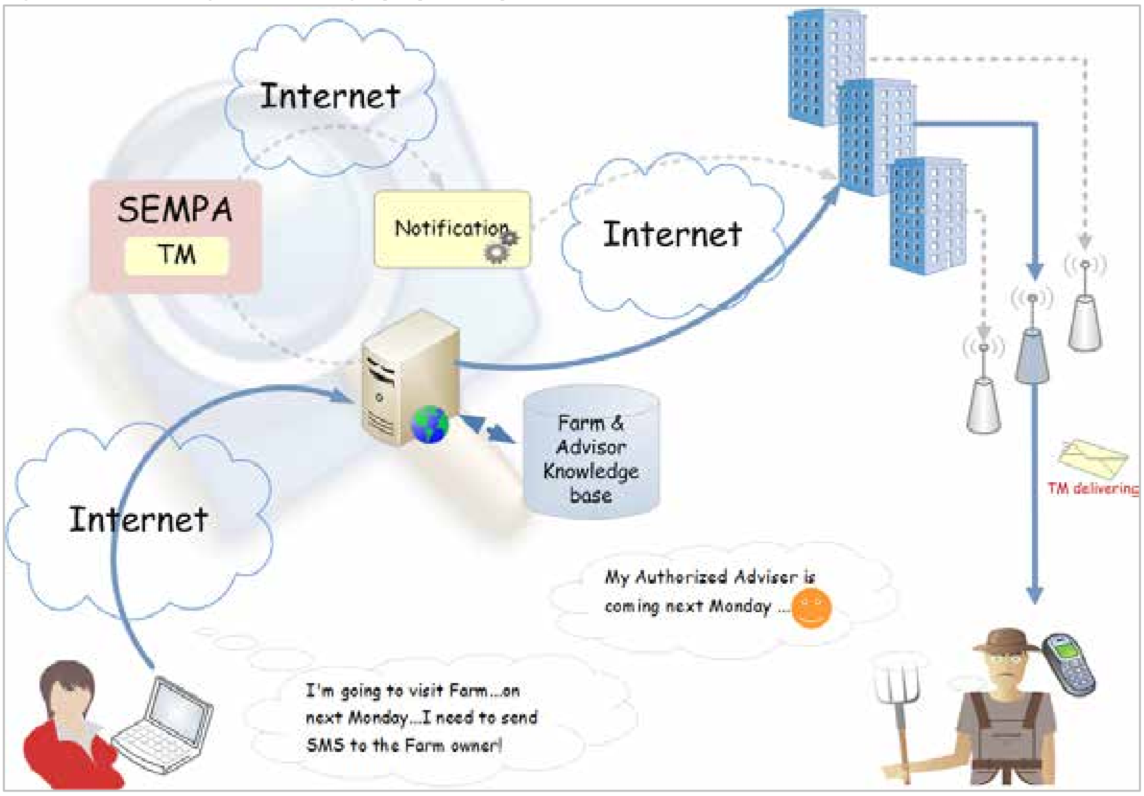
In accordance with the aforementioned needs, with functionality that provides SMS messaging module it provides a permanent, stable, simple and fast communication between Advisers and the cooperating farmers, and it results in enhancing and improving the quality of services provided by NEA to farmers.

Communication achieved through SMS messaging is the most reliable way for permanent communication between advisers and farmers, given the fact that the activity of farmers takes place in the field and the only way to communicate with them in real time is via their mobile phones. Besides the permanent availability, this mode of communication is characterized by:

- High speed
- Safety
- Simplicity
- Efficiency
- Convenience

In other words, the basic usage of the SMS module is informing and notifying target group for organizing various appointments, meetings, trainings etc., as well as informing about the activities of NEA and cooperating institutions, in relation to: conducted analysis, surveys, questionnaires and their results, various programs and subventions, benefits, procedures and regulations etc.

Figure 8 Utilizing Text message (TM) in the process



28.7 Types of analyzes, reports and benefits

Complete picture of the situation of micro and macro data from farm and surrounding of the farm in the rural areas enables comparison of geographical locations and time periods.

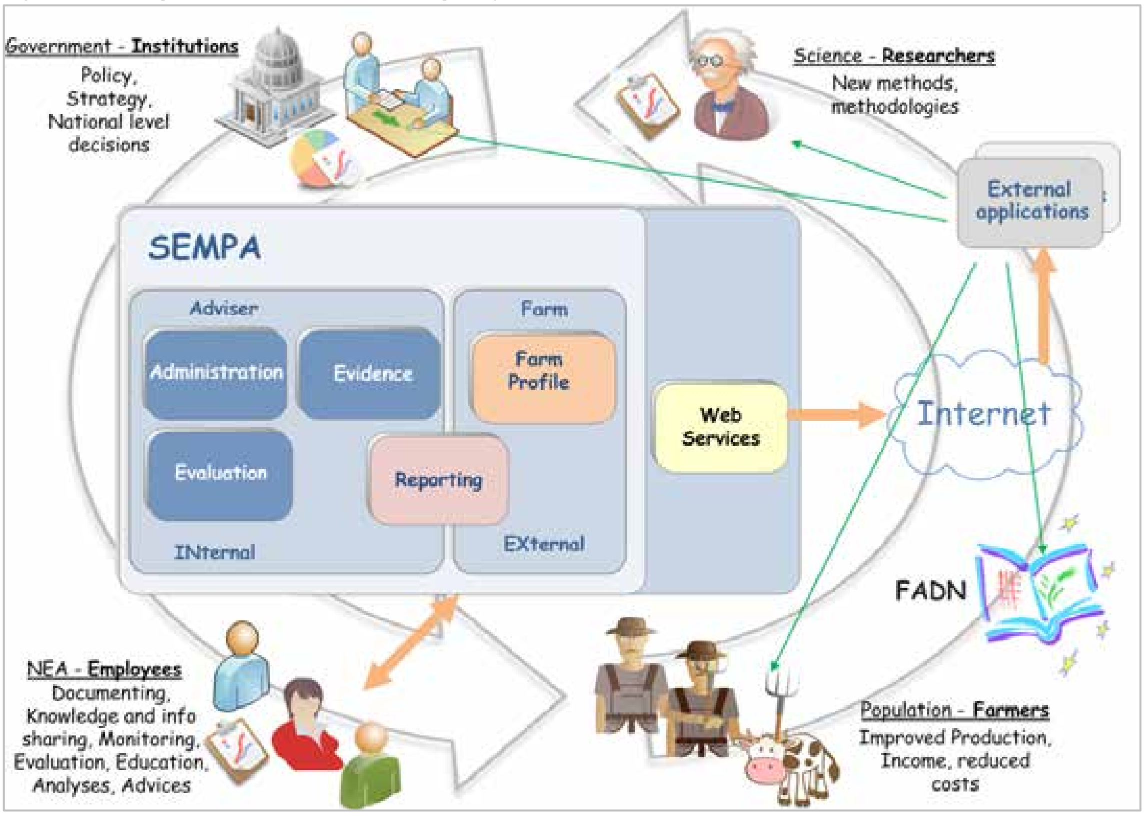
From the analysis that can be prepared from Farm profile, an essential part is practical application of the analyzes and reports directly to customers in the form in accessible and understandable way of showing, in particular:

- Advisors
- Farmers

- Research
- Education
- Processing industry
- Input Suppliers
- Rural Community
- Associations of farmers
- Producer Groups

Data in the direction of building policies, comparative analysis at the international level, scientific research purposes and so on, are available in the system with appropriate access.

Figure 9 Improved services and data quality for Stakeholders



Different categories of data from Farm Profile allow various analyzes according to various criteria and by different stakeholders: Farmers, NEA, Government, Science, FADN, each from its own angle. The benefits of these analyzes are shared and multiple whereby, directly or indirectly, the ultimate benefit is on the side of the Farmer.

- Use of Accountancy data for Farm (General Info, Production Data, Resources, Finance)
- Use of Data beyond accountancy data for Farm - Advises, List of Advisers, Questionnaires
- Use of Combined data - Advises & Accountancy Data for Farm

The Accountancy data for Farm encompasses the following categories of data:

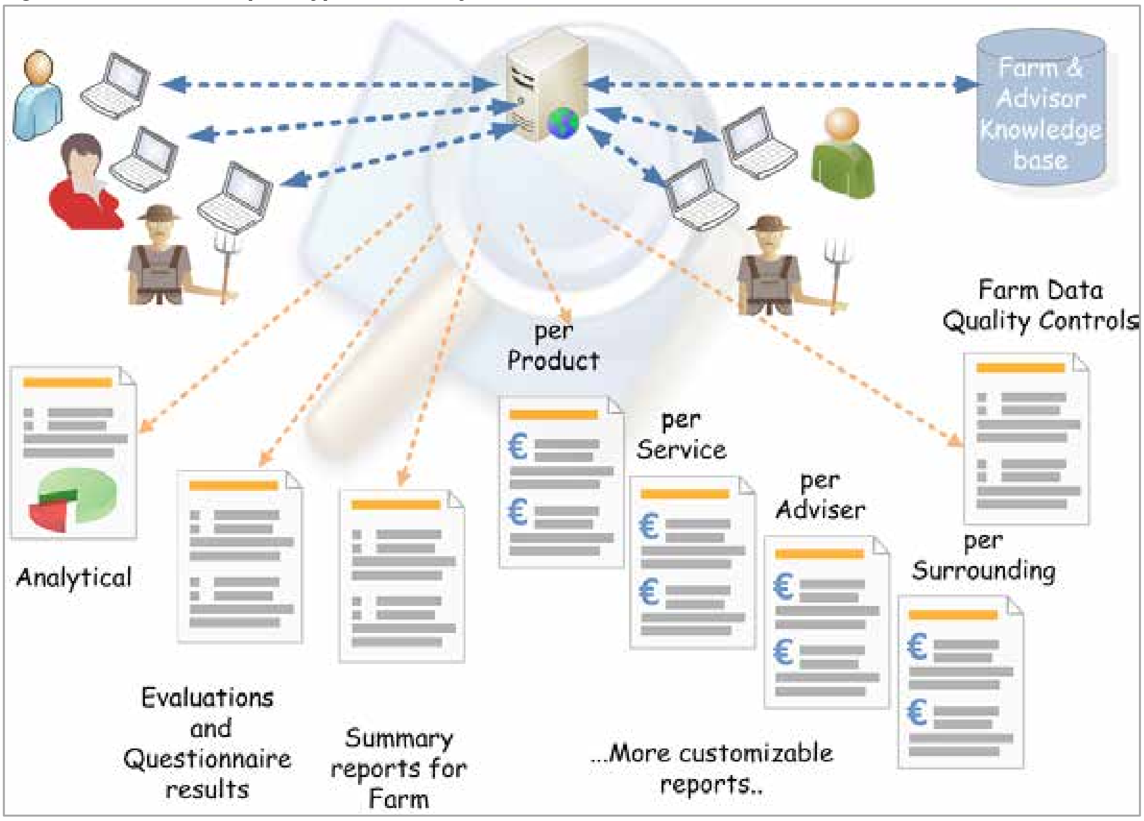
- General Info for Farm (Location, type, name, Farm Owner/Associations of Famers...),
- Production data (Yield, Income, Costs,..),
- Resources (Material, Human, Natural),
- Finance (Debts, Investments, Subsidies,..)

Farm Profile accountancy data could be analyzed per different criteria (per Product, per Farm or Farms, per Region and/or Locations, per years...) and for plenty of objectives.

The **data beyond Accountancy data for Farm** encompasses the following categories of data:

- Advises
- List of Advisers
- Questionnaires

Figure 10 Various Report Types and Analyses



28.7.1 Benefits from reports and analyses

The benefits from analyses of the accountancy data and the data beyond them, are also unlimited and for all interested parties whether for NEA - Employees, Government - Institutions, Science -Researchers but in first place for the Farmer. Some of the core benefits:

- **Easier finding and planning of placement for products and marketing** - for Farmers, Farmer Associations and Municipalities
  The reports of planted hectares in certain cultures in locations and /or regions and their analyses can help in planning of the yield and thus for marketing purposes. With these analysis, the NEA may make recommendations to farmer associations, municipalities so they can easier act in finding the placement of the products of their farmers.
- **Planning the development of the agriculture sector** - for Farmers, Farmer Associations and Municipalities
  Based on reports of available land for farms in a particular region / municipality, especially untilled land and their analysis, the municipalities have the option of planning the development of the agricultural sector.
- **Foundation for micro and macro analyses -> guidance for application of new methods. methodologies and technologies -** for Farmers, NEA, Researchers

The analysis of farm production data by region, compare the results of production by region, and in particular the analysis of the cost of production by product and per region Farmer Profile provides a basis for scientific institutes carry statements and accordingly to provide guidance on the application of new scientific and technical developments.

- **Foundation for FADN surveys** - for Government Institutions, Farmers
  Data from Farm Profile as a nationwide data are basis from which to generate the necessary data for FADN which are primarily used to assess the need for subsidies and investment in that production that is of national interest.
- **Use of data for ADVISES - BENEFITS for Adviser, NEA, FARMER**
  Farm Profile gives an accurate overview of WHAT services are given to the Farmer whether they are:
  - Education
  - Training
  - Skills transfer with presentation
  - Interactive sessions
  - Adviser packages

  The advices can be analyzed per: type of Advise, Specialty, Period,...

Use of data for ADVISERS - BENEFITS for Adviser, NEA, FARMER
Farm Profile gives an accurate overview of WHO gave services to the Farmer and that could be used for comparative analyses who is possible credited for either good or bad results of Farm, the Adviser or Farmer.

The practice show that does not mean good / bad results is credited with one hand. There are situations that same advice from a same Advisor given to two Famers does not have same effect to the Farms production. Having the Farm profile, and with comparative analyses for more farms with a same production type, the problematic side could be more easily located since the participation is mutual, and the results depend on quality of service provided by advisor on one hand and on other hand, quality of farm data collected (provided by the Farmer) along with the proper application of the service by Farmer.

Use of data for Questionnaires for Farmer - BENEFITS for Adviser, NEA, FARMER
Data for Needs and requirements of farmers for advisory services, particularly for

- **Specific areas:** Animal Husbandry, Crop, Agro economy, Gardening, Organic production, Vine - Fruit, Environment
- **Most convenient time:** Morning/Afternoon, Workday/Weekday, Month of the year
- **Way of delivering advisory services**: Presentation, Training, Television Shows, Practical activities, Short notices (e-mail, SMS, radio, mobile phone), Use of materials (printed brochures, booklets, guides, manuals,..)

Analyses of the data are Useful for:

- Farmer - for improving of his development
- Advisor, NEA - for planning advisory services, time and budget

Data for Customer (Farmer) satisfaction and ratings

- **Per Advisory service type:** Presentation, Training, Practical realization
- **Per Topics and Quality of topics**: Understandability, Usefulness, Acceptability, Applicability
- **Evaluation of Advisor:** Articulated/ Conceivable, Courtesy, Communication, Interactivity, Appropriate approach, Competency

Analyses of the data are Useful for:

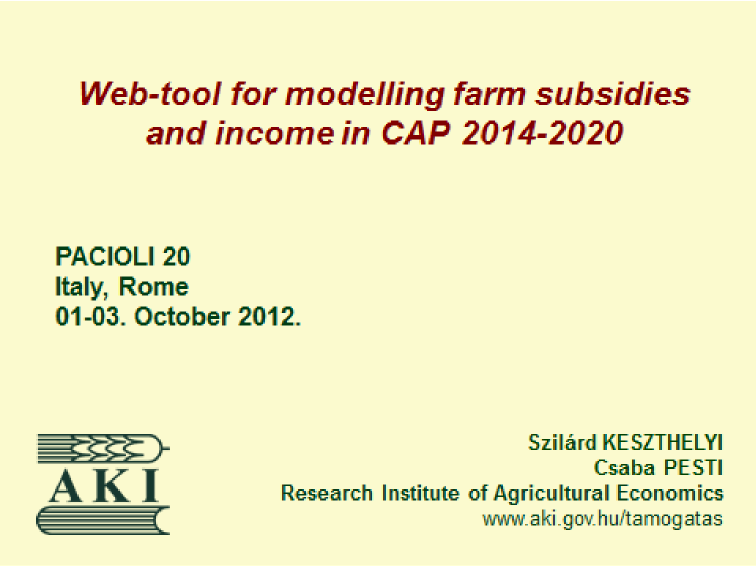
- Advisor - for self improvement, improving advisory services and thus for Farmer

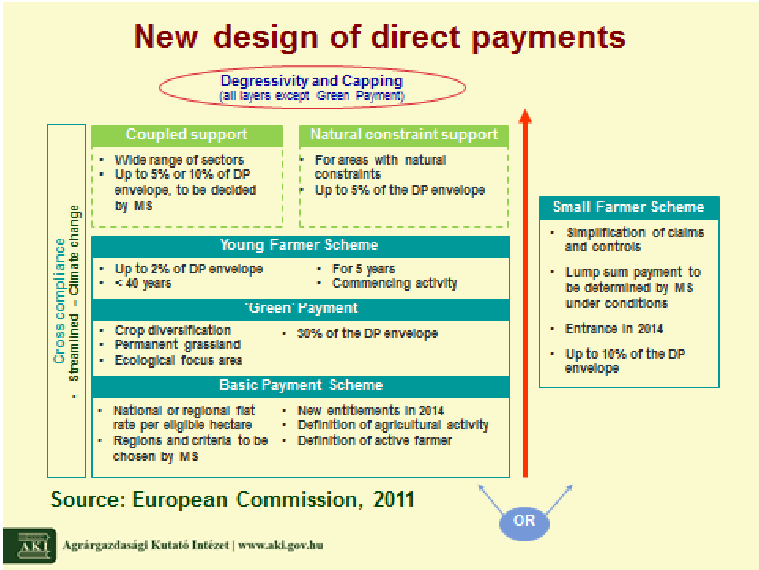
28.8 Conclusion

The development of the EU Regulation for FADN and the development of the EU Regulation for the Advisory Services are mutually dependent and the implementation of both will contribute for improvement of the quality of FADN data.

29 Web-tool for modelling farm subsides and income in CAP 2014-2020

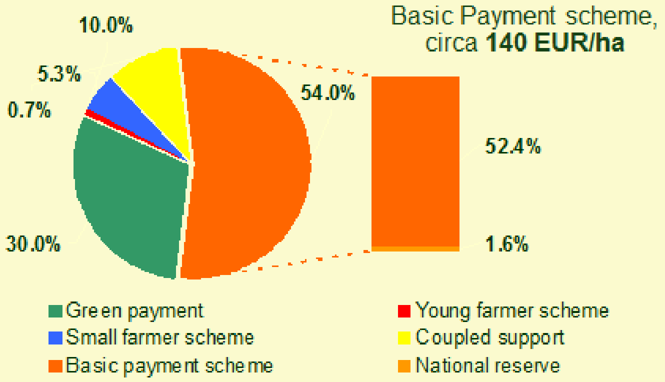
Szilard Keszthelyi





Direct subsidies in Hungary

Calculation of Research Institute of Agricultural Economics (AKI)



Agrárgazdasági Kutató Intézet | www.aki.gov.hu

Source: AKI, Agricultural Policy Department, 2012

Green payment

30% of total I. pillar. Based on calculation of AKI it is **80 EUR/hectares**, for this 3 criteria must be fulfilled

- **Diversification**

  We recommend to increase the limit to 10 hectares

  The 3 hectares limit means problem for 35 thousands farm

- **Maintaining grassland**

  Not a problem for the Hungarian farms

- **Ecological Focus Area (EFA)**

  Extra cost for 90% of total Farms

  Instead of 7% we recommend to keep the level of EFA areas or applying it on a higher level

Agrárgazdasági Kutató Intézet | www.aki.gov.hu

Source: AKI, Agricultural Policy Department, 2012

Small farmer scheme (SFS)

1000 EUR/farm is to be the lump sum

100-110 thousands farms are to be in normal system

- 70 thousands farms will choose SFS (based on FADN)
- Total 70 million EUR, 5,3% of total I. pillar subsidies, 3% of eligible area
- Extra 33 million EUR compared to the normal system
- Only one registration opportunity 15. October 2014, communication is key issue

Agrárgazdasági Kutató Intézet | www.aki.gov.hu

Source: AKI, Agricultural Policy Department, 2012

Subsidy Calculator (www.aki.gov.hu/tamogatas)

Customized subsidy forecast
Only a few data must be provided (e.g. hectares, number of animals) and software calculates the expected subsidies for 1013 and 1014.

Further services:

- Short description about the expected direct subsidies
- Alerts in case the farm does not meet the requirements of greening payment
- Customized introduction of new cross compliance
- Free newsletter about the changes of new CAP
- Personalised extension services (e.g. for credit request)

Output of Subsidy Calculator (www.aki.gov.hu/tamogatas)

Expected direct payments

2013 - Old system	2014 - New system
SAPS	Basic payment
Milk premium	Green payment
Rice	Young farmers schemes
Suckler cows	Coupled payments:
Beef	Suckler cows
Ewe premium	Beef
Cattle extensification	Milk premium
	Ewe premium
	Capping

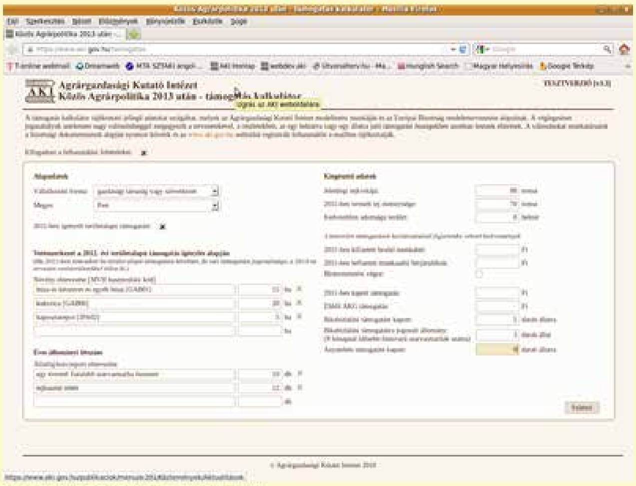
Output of Subsidy Calculator 2 (www.aki.gov.hu/tamogatas)

Alerts

- Green payment (area bigger than 3 hectares, 3 different crops etc)
- Maintaining grass on the surfaces which were permanent grassland (5% decreasing allowed)
- Ecological focus area (EFA) less than 7%.

Cross compliance (filtered)

Input sheet



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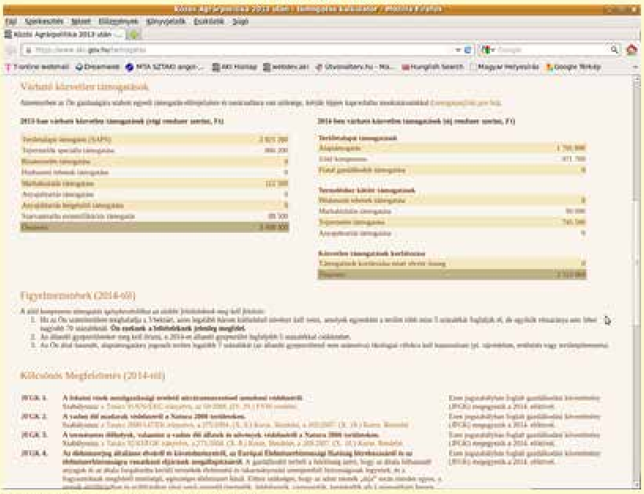
Results



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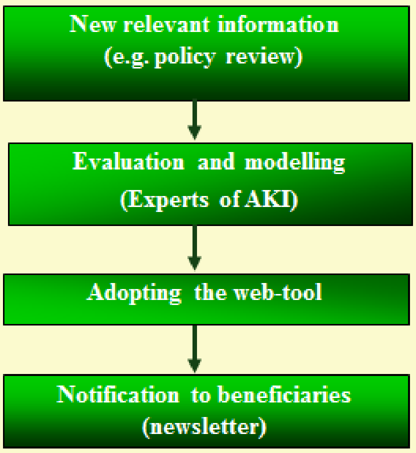
Maintenance of the system



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This has been the first step…

Future development

Benchmark and forecast the changing of income level

Providing estimation for the profitability

Basis and concepts:

- FADN based
- EU typology
- Microsim (Microeconomic simulation model)

Output structure

For each type and size groups

Description	Unit	Farm data	Avarage	Avarage of best 25%	Avarage of worst 25%	Avarage 2013	Avarage 2014
Farm size (SO)	tHUF/farm						
Revenue	tHUF/ha						
Direct subsidies	tHUF/ha						
Total output	tHUF/ha						
Material costs	tHUF/ha						
Paid wage	tHUF/ha						
Depreciation	tHUF/ha						
Total costs	tHUF/ha						
Profit before tax	tHUF/ha						
…							

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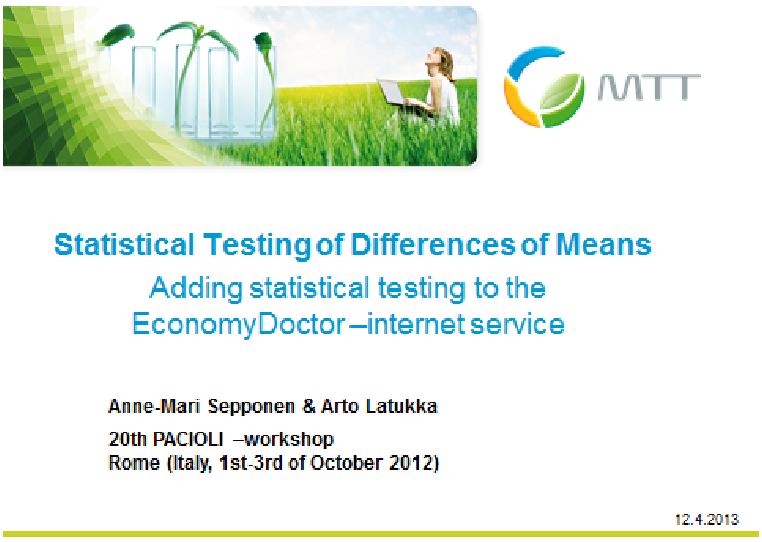
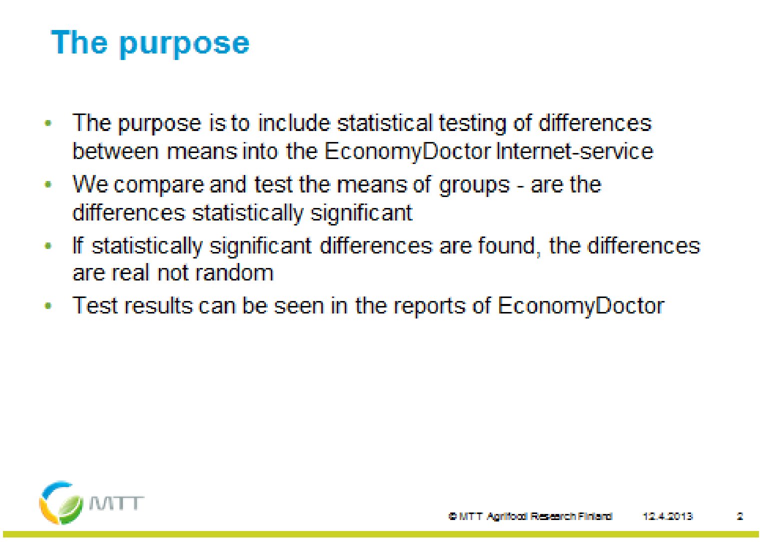
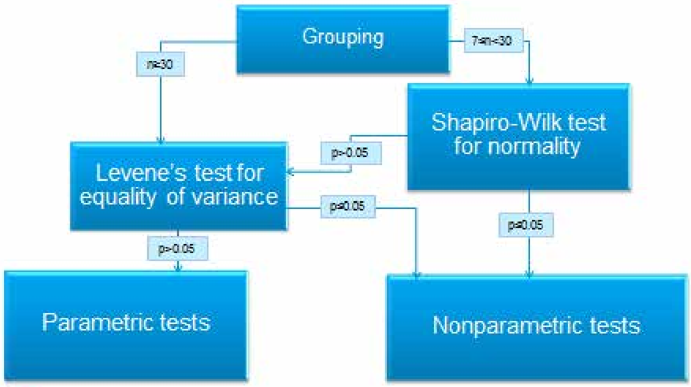
30 Statistical testing of differences of means in EconomyDoctor internet service

Arto Latukka





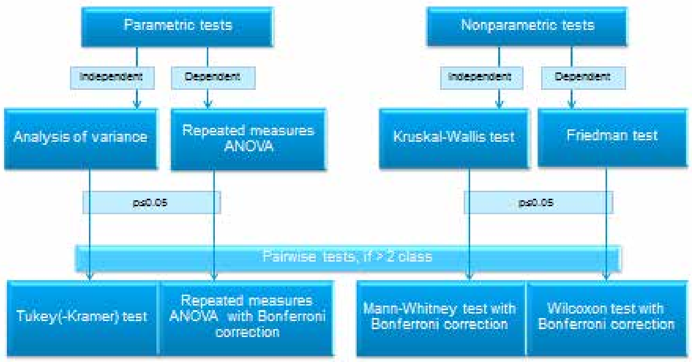
The presumption tests



The presumption tests

- The presumptions of the parametric tests are tested if necessary
- If the size of group is big enough the normality can be presumed
- Normality is tested with Shapiro-Wilk test and equality of variance is tested with Levene's test
- If the presumptions of parametric tests don't come true then nonparametric tests are used

Testing of differences of means/medians



Testing differences of means

- The presumption tests define whether parametric or nonparametric test is used in testing differences of means
- Variables can be dependents or independents and it rules which test can be used
- In independent groups observations are from different observational units
- The observations in dependent groups are from same observational units in the different groups

Testing differences of means: Independent situation

- Parametric:
  - The used method is analysis of variance
  - The analysis of variance tests differences between means
  - The test is based on comparing differences within and between the groups
  - The statistical test is F-test which tells probability to dismiss null hypothesis

Testing differences of medians: Independent situation

- Nonparametric:
  - If the presumptions of the analysis of variance don't come true then nonparametric Kruskal-Wallis test is used
  - The Kruskal-Wallis test study differences between medians
  - The null hypothesis is that medians of groups are equal
  - The test is based on remainder of means of rank of data and group

Independent situation: Pairwise tests

- If the tests prove that means or medians are different from each other statistically significant we also test differences of means or medians pairwise
- The pairwise tests take into account the growth of significance level caused from consecutive tests
- In the situation of analysis of variance the pairwise test is Tukey test or Tukey-Kramer test depending on if the groups are same size or not
- In the situation of Kruskal-Wallis test the used pairwise test is Mann-Whitney test with Bonferroni correction

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Testing differences of means: Dependent situation

- Parametric:
  - The used method is repeated measure analysis of variance
  - The repeated measure anova is used when variables are dependent – values of variables have been measured more than once in same observations
  - The null hypothesis is that means are equal in different groups

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Testing differences of medians: Dependent situation

- Nonparametric:
  - If the presumptions of the parametric test don't come true then nonparametric Friedman test is used
  - Friedman test is nonparametric equivalent to repeated measures analysis of variance
  - The test studies if the treatment influences on rank distribution of variables
  - The test statistic F follows the Chi^2 distribution

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Dependent situation: Pairwise tests

- If the repeated measures ANOVA proves that means are different from each other statistically significant we also test differences of means pairwise with Bonferroni correction
- Bonferroni correction fixes the growth of significance level
- If the nonparametric Friedman test proves that medians are different from each other statistically significant we also test differences of means pairwise by using Wilcoxon test with Bonferroni correction

Significance levels in the report of EconomyDoctor

Source: Profitability bookkeeping results of MTT Economic Research (www.mtt.fi/economydoctor). November 14, 2012

Production Costs divided by milk_yield	2010				
	Dairy Farms				
	Subsidy_Region_C4	Subsidy_Region_C3	Subsidy_Region_B	Subsidy_Region_A	Average
Farms represented	110	780	1 640	400	2 930
Farms in sample	7<=n<14	30<n<40	30<n<40	20<n<30	100<n<110
Arable land	33.4	50.4	55.4	69.4	55.2
Livestock Units	23.9	37.0	43.1	55.5	42.5
PRODUCTION COSTS ( )	**1,180**	**1,161**	**1,084**	**0,947**	**1,089**
Material costs (***)	**0,271**	**0,234**	**0,169**	**0,164**	**0,189**
Fertilizer, Lime ( )	0.037	0.037	0.028	0.030	0.031
Other crop production costs ( )	0.023	0.030	0.023	0.026	0.025
Fuel and lubricants (*)	0.032	0.040	0.022	0.023	0.027
Electricity ( )	0.033	0.021	0.019	0.019	0.020
Forage costs (***)	0.143	0.107	0.076	0.065	0.085
Livestock costs ( )	[illegible]	**0,052**	**0,056**	**0,036**	**0,052**
Livestock purchasing ( )	[illegible]	0.008	0.007	0.001	0.006
Other livestock costs ( )	[illegible]	0.044	0.049	0.036	0.046
Machinery cost ( )	[illegible]	**0,215**	**0,177**	**0,143**	**0,182**
Depreciation of machines (*)	0.115	0.135	0.091	0.080	0.102
Other machinery costs ( )	0.053	0.080	0.086	0.063	0.080

Significance levels

* = significant at the 0.05 level
** = significant at the 0.01 level
*** = significant at the 0.001 level

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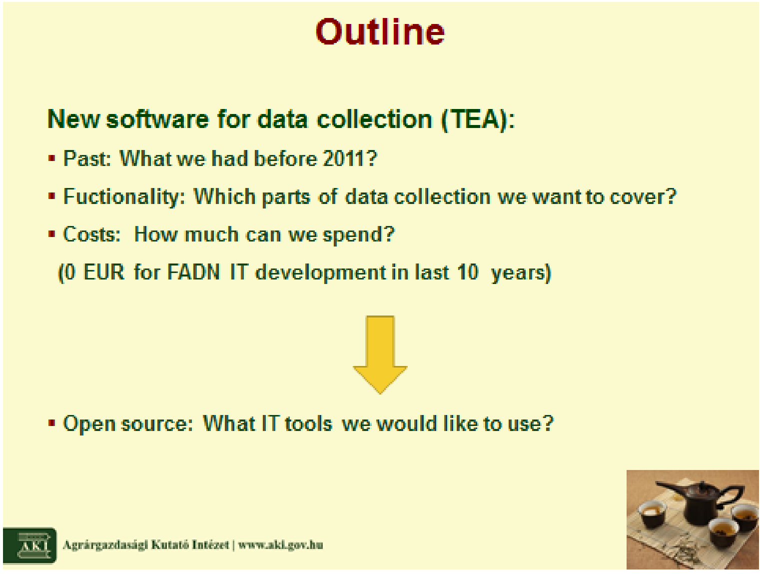
31 Open source solutions in Hungarian FADN: data collection and income modelling

Csaba Pesti

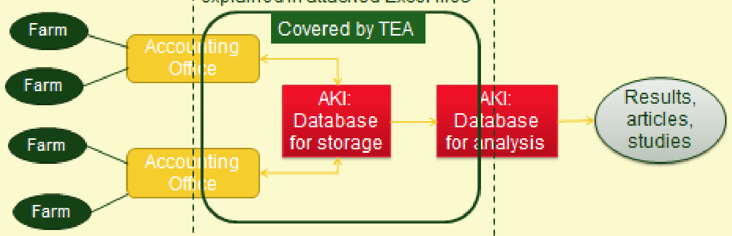


Data flow and software functions

Own accounting software for each accounting office.

12 years old Foxpro software was used for data entry and quality checks.
Data was sent via e-mail, errors explained in attached Excel files

Data was stored on each workstation in Dbase4. Queries into Excel.



Accounting softwares remained: manual data entry or import into TEA.

Thin client solution: internet browsers are used for data entry and quality checks. Data is stored only at central database.

Data is converted into a format that is easy to analyse (one farm one row). SQL queries are written manually by FADN Unit staff.

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Open source vs commercial softwares

Oracle / Microsoft SQL + .NET Framework

- Software licence costs (40-60,000 € per year)
- High costs of upgrading
- Support available
- No surprises/hidden bugs (or at least less)
- Slightly lower costs of programming

MySQL + PhP (or Java)

- No licence/upgrade costs
- No database support (sometimes it would be useful)
- Easy to find a programmer
- Surprises/hidden bugs give extra hours/days for programming
- Higher costs of programming

No need for over-capacity: FADN is a small database, only a few millions of records. A few hours downtime does not make big problems.

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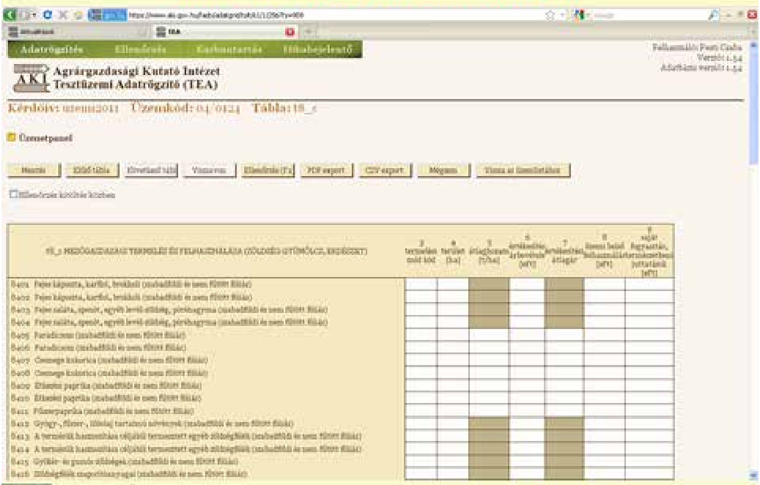
Data entry to MySQL server at AKI



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Quality checks and explaining of errors

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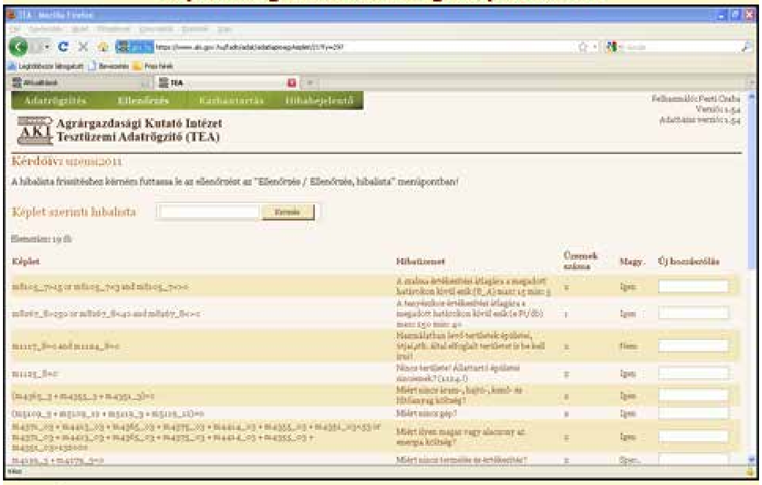
Explaining errors for a group of farms



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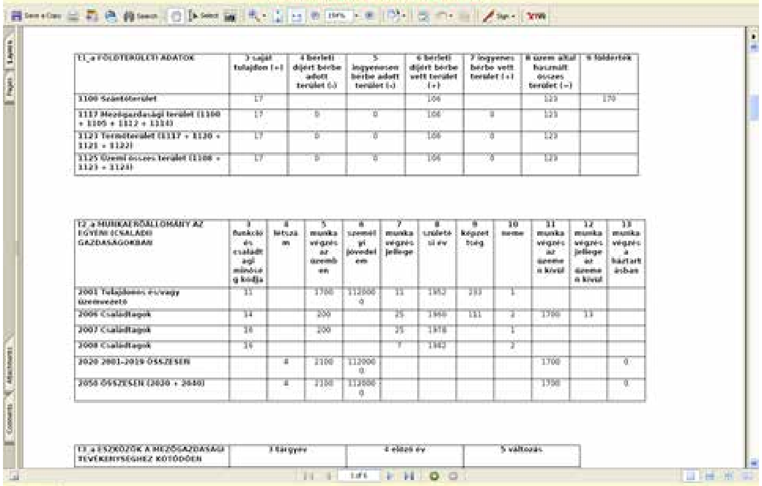
Data export to Pdf



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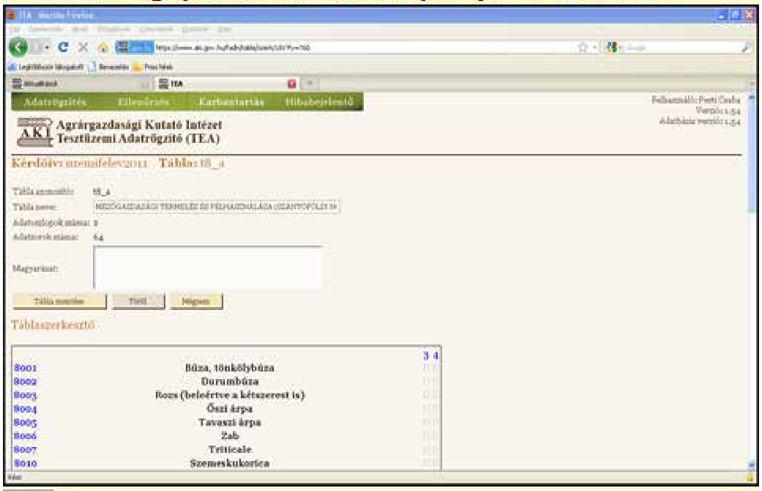
Editing questionnaires and quality check formulas



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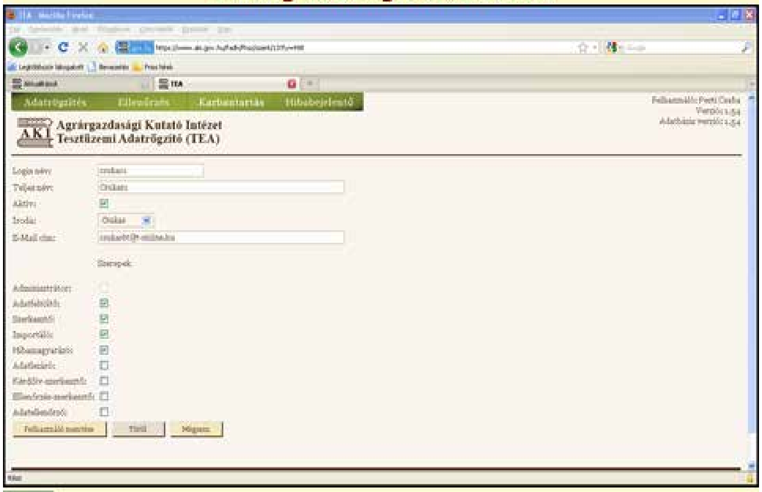
Editing user rights and roles



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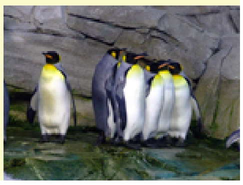
Lessons learned

- In open source environment we have to calculate with surprises: bugs in PhP, errors in MySQL → forums, mailing lists etc. (add some spare man-days for these bugs)
- It's OK to survive without database support, but there is a need for well-trained staff at server maintenance level (IT Department)
- Resistance to change: much more complicated than software development:
  - Resistance of AKI's management: Why to spend money?
  - Resistance of accounting offices: Why to change a software which works?

Have either time or money:

Time: open source
Money: commercial software



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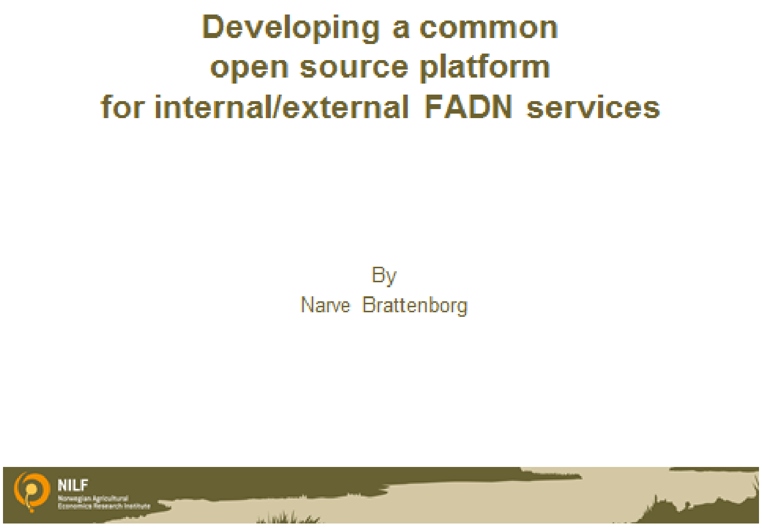
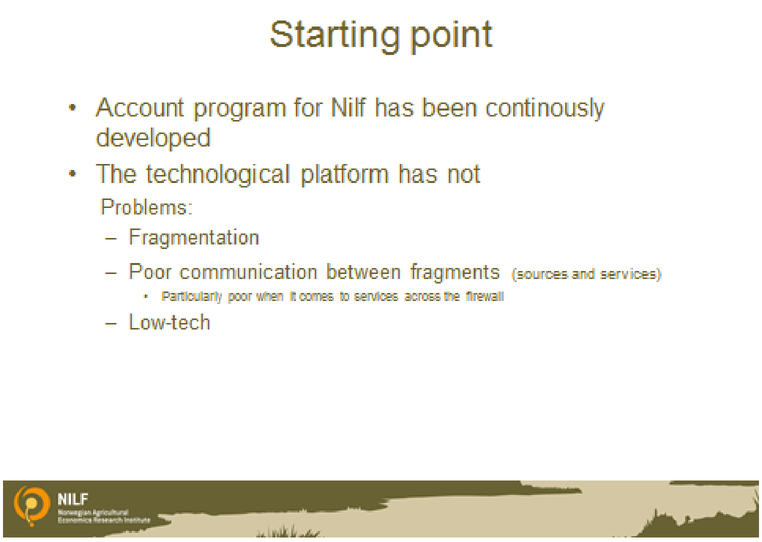
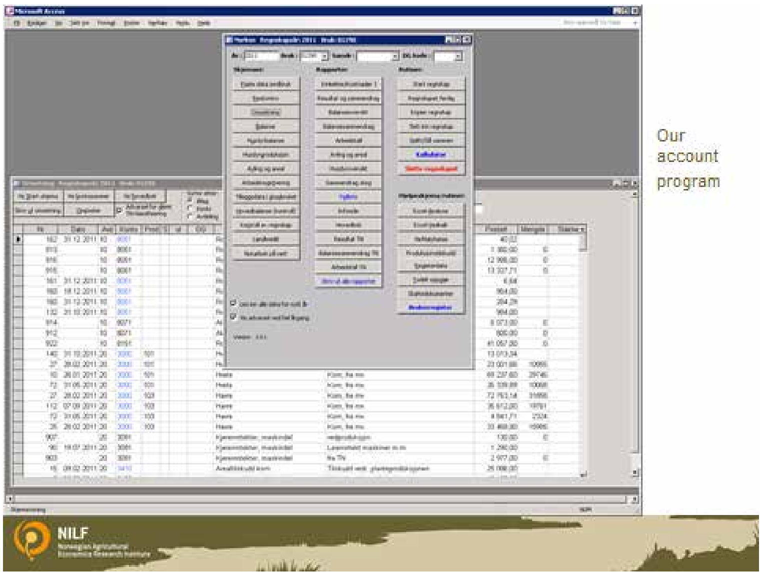
32 Developing a common open source platform for internal/external FADN services

Narve Brattenborg

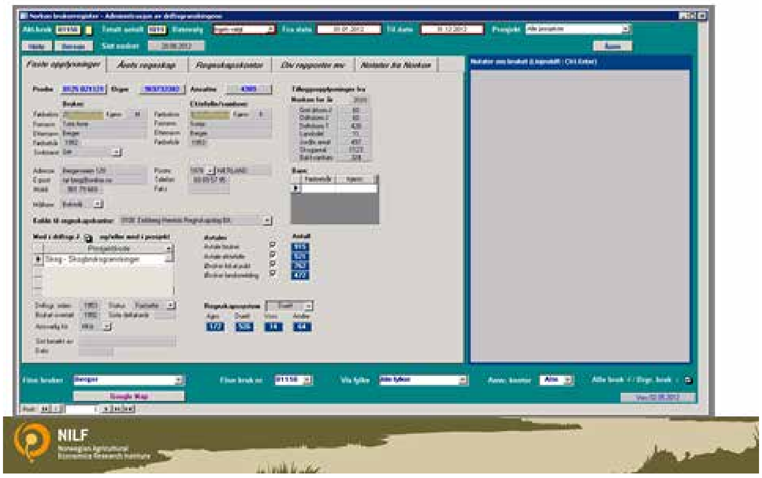




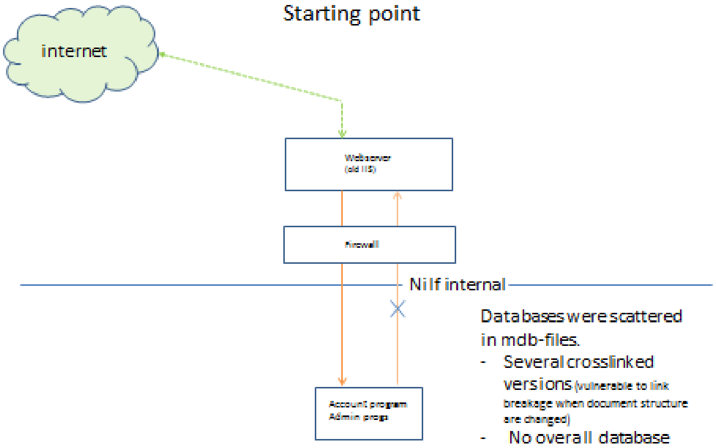


Our account program

Program for status and administration of participants



Starting point



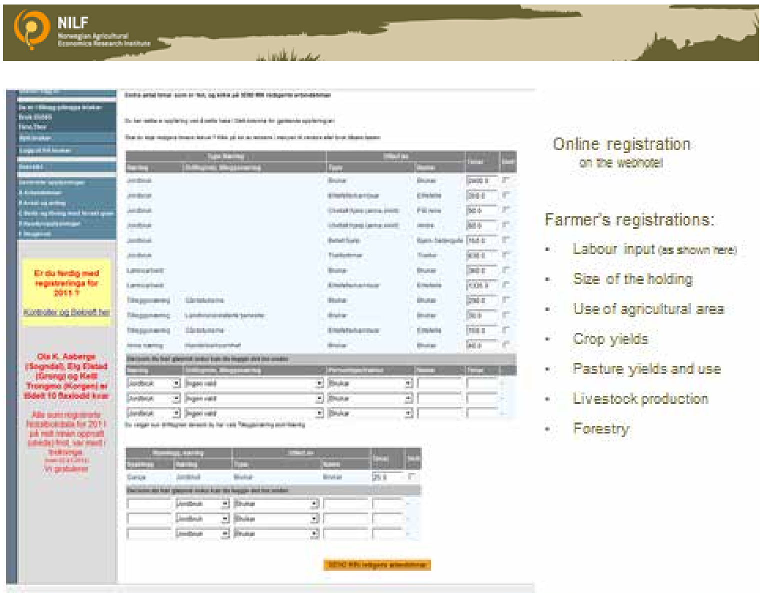
Databases were scattered in mdb-files.

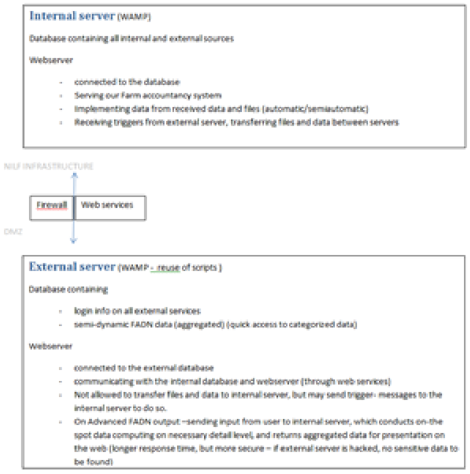
- Several crosslinked versions (vulnerable to link breakage when document structure are changed)
- No overall database structure

At seasons end: account data is aggregated, converted and stored in Oracle for publications and statistical purposes (static)

First steps (temporary solutions)

- On the old webserver: secure upload service
  - Accountants upload annual accounts and tax documents
  - uploaded files requires a combination of automated and manual handling
- On the webhotel
  - LAMP (open source Linux/Apache/Mysql/Php)
  - Online registration forms (with admin and export solutions)
  - Importing non-sensitive data from external sources into the database, and accessible on the web (for internal use, a tool for NILF accountants)
  - A forum with email notifications (for internal use, between NILF accountants)
  - References, documentations, etc. (for internal use, a tool for NILF accountants)
- Start planning a new platform on our own servers
  - The same solution as on the webhotel (but WAMP). The new apps from the webhotel will be portable when the new platform is in place and stable.

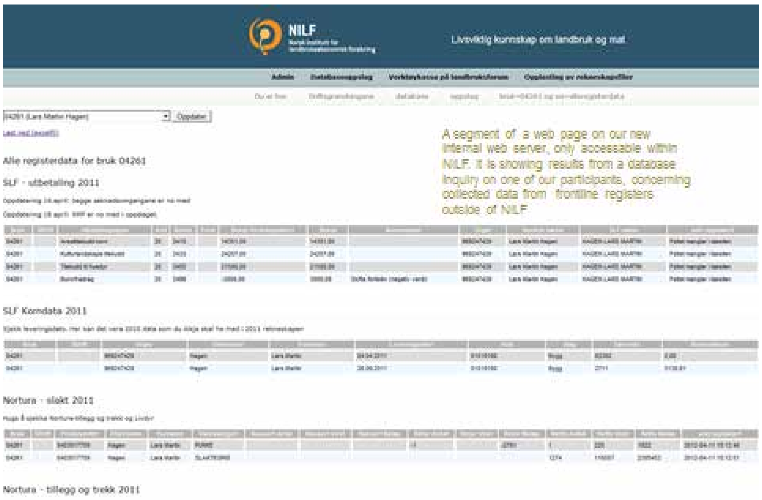




Stage 2: Setting up a new platform

- 1 server inside the firewall
- 1 server outside the firewall
- A web services tunnel between them
- A web browser is used as the client software for the new services on both servers
- All mdb databases are imported to the new internal database
- All queries from existing Access/ Excel apps and docs are rerouted to the new database (other adaptions in scripts were made)

NILF Norwegian Agricultural Economics Research Institute



A segment of a web page on our new internal web server, only accessable within NILF. It is showing results from a database inquiry on one of our participants, concerning collected data from frontline registers outside of NILF

NILF Norwegian Agricultural Economics Research Institute

FADN output

- These presentations were made on a web hotel 3 years ago. The computations were made on the source data and the graphs/tables were generated automatically
- By importing the next year's source data, they would automatically appear in the presentations
- However, we were kindly asked by the webhotel manager to reduce our strain on the shared resources, so the project was postponed.
- With our new server in place, the work will be resumed next year

NILF Norwegian Agricultural Economics Research Institute

33 IT tools and target users of the Italian RICA data

M. Martino, A. Scardera, A. Bodini

33.1 Objectives

The following overview describes briefly the architecture of RICA management in Italy and its main IT tools, some of which are fully implemented while others are under development. Target users and their main information needs for each tool are described.

33.2 Italian RICA and IT management

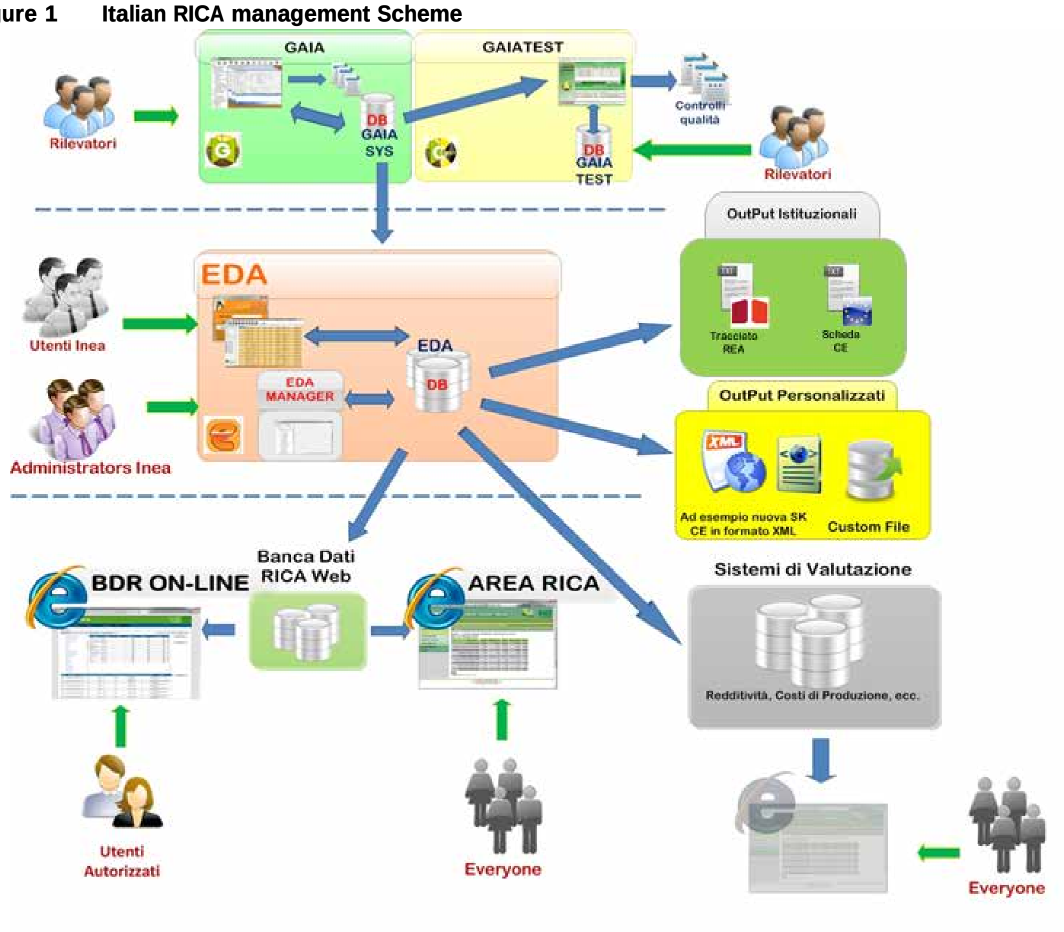
Figure 1 shows the flow of data throughout Institutions involved in the use of FADN in Italy, namely the liaison agency INEA and its network of data collectors.

The main software implemented by INEA are GAIA (Gestione Aziendale delle Imprese Agricole) and GAIATest. Whereas the former has been developed to store data in an organized way, the latter is meant to check data. They are both necessary to deliver data to RICA-1 portal of Dg-Agri in compliance with the EU Regulation 868/2008 and the latest farm return (Eu Reg. 385/2012).

GAIATest is used to verify data received from data collectors by the regional coordinators. After coherence tests are run and checked by data collectors and double checked by regional coordinators, data is extracted by the software EDA (Estrazione Dati Avanzata). With this tools the Farm Return can be extracted, as well as other institutional outputs, such as the economic accounts to be sent to the national institute of statistics ISTAT.

In the following part GAIA, EDA and Area RICA are presented.

Figure 1 Italian RICA management Scheme



33.3 GAIA: aims, functionalities and utilities

GAIA has been developed for farm return, thus to store structural, technical and economic information of the sample farms. Gaia allows data registration and archives storing, and reporting for farm management, such as income statement, economic and structural index report.

GAIA elaborates and produces information in a wide range of ways. Firstly, information is directly shown in the data entry process and elaborated into reports. Secondly, GAIA includes general accountancy data, details of single production processes (gross margin included). Thirdly, information collected provide a comprehensive overview of overall farm management and single operational aspects. Fourthly, a structured system of indicators and ratios provides management results and complex information framework with regard to economic results and corporate capital's use.

Figure 2 GAIA logo

With **GAIA Test,** a checking application, data checks are organized by farm and at different levels of severity (severe to warnings), in line with Eu Commission tests.

The software can be downloaded for free from www.gaia.inea.it. Once registered on the website technical (IT) support and methodological assistance are provided.

***Target users** can be grouped in two groups:*
Firstly, INEA data collectors to keep records for the survey. Thanks to the navigation tree the information can be organized in compliance with farm return. Furthermore the tool allows Input data check and Coherence data check afterwards.

Secondly, farmers or any other external users (accountants, school teachers) willing to keep accounts in compliance with accounting standard, depreciation method and allocation of costs. By means of different reports (income statement, livestock management) the software allows to evaluate farm performance along different accounting years and to prepare documentation to RDP measures application.

Reports generated from GAIA are income statement, economic and structural index report, which are usually printed and given to the farms at the end of the survey, so that farmers can have a feedback on their accounts based on the survey.

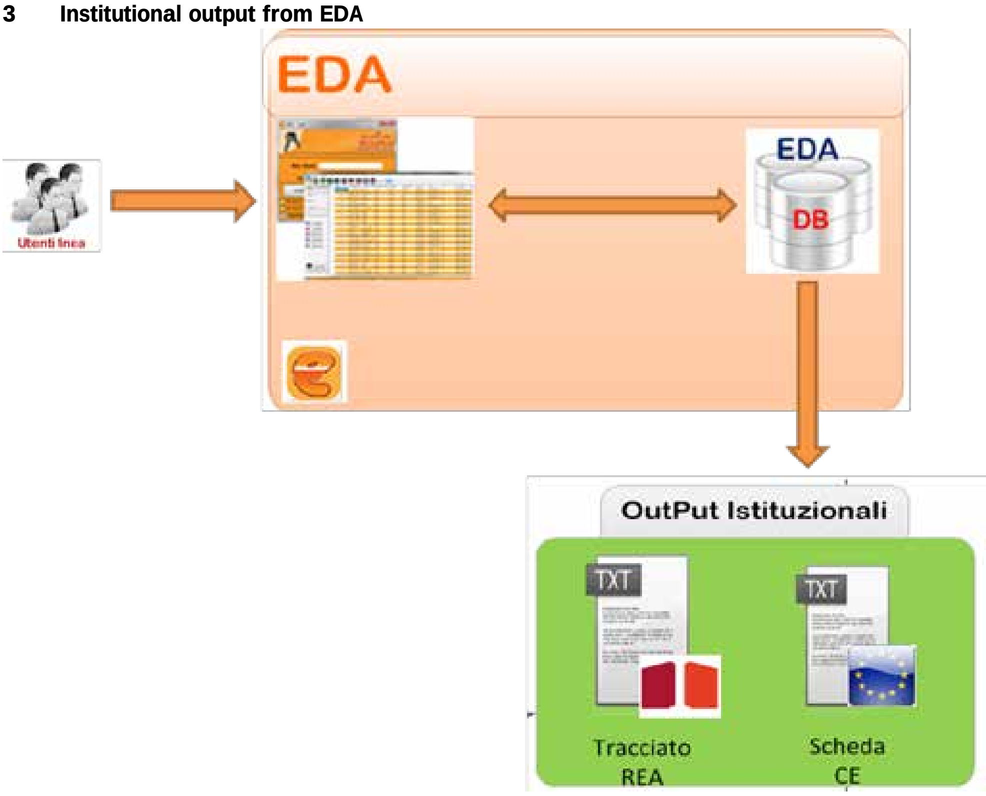
GAIA database is based on a transational model where data is represented as relation (from graphic point of view as a table) and handled according to relational operations. The relational model allows creating a logic and consistent representation of the information. Consistency can be achieved by imposing constraints, in technical terms is called logic scheme. The access to data is managed by a Database Management system (DBMS), which in this case is SQL MS which do not always follow the logic scheme. This is a controversial issue as to improve the DBMS performance you need to modify the logic scheme.

EDA is based on the ETL ExtractTransformLoad process and involves:

- Extracting data from outside sources (i.e. Gaia)
- Transforming it to fit operational needs (which can include quality levels)
- Loading it into the end target (i.e. database uploaded into Rica 1 portal)

EDA extracts data in different file extensions, suited to Farm Return to Dg-Agri and to Agricultural Economic Results to ISTAT. Eda allows in practical terms to comply with regulation and SISTAN requirements (the Italian national statistics network).

Figure 3 Institutional output from EDA



33.4 BDR Web

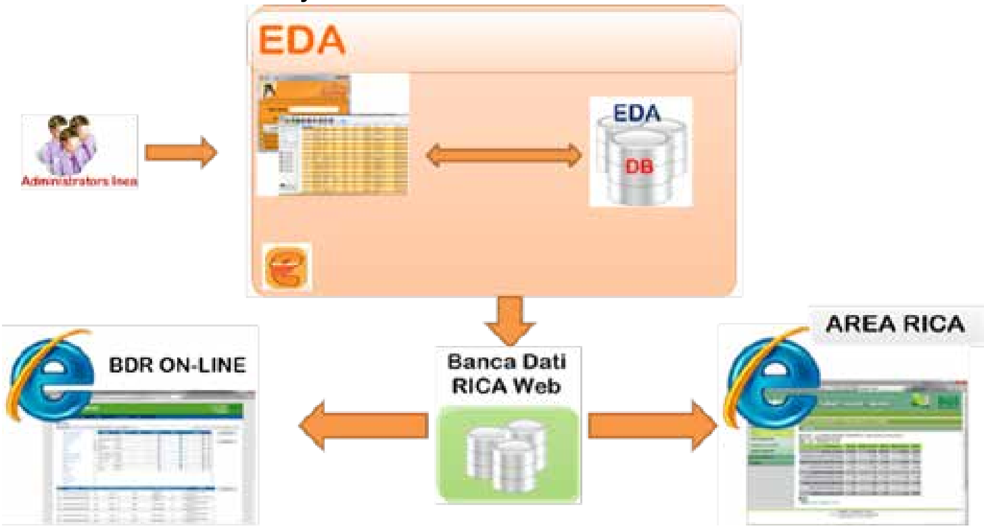
There are two ways to access data. The fist, called BDR on-line, is meant for authorized users only, as access is given to individual data, however agricultural holdings are identified by an anonymous code. Among authorized users there are SISTAN users, which are those public institutions sharing sensitive data under common confidentiality policy.

The second tool, called **Area RICA**, is the public Italian FADN database, which is a virtual area accessible from http://www.rica.inea.it/public/it/area.php. Target users are analysts willing to have ready-to-use information without querying the database. In fact the DB allows to analyze the farm return a regional or national level. In this public platform access, data is presented in aggregated form (at least 5 observations) according to stratification criteria (region, farm type and ESU).

The content (variables and topics), selected among the most relevant requests received by INEA and classified according to FT and ESU, is structured as follows:

- Farm Structure and Income,
- Crop and animal specific costs and revenues,
- Olive oil and Wine as specific sectors,
- Time series: per region, per crop and animal operation,
- Sample and weighted averages.

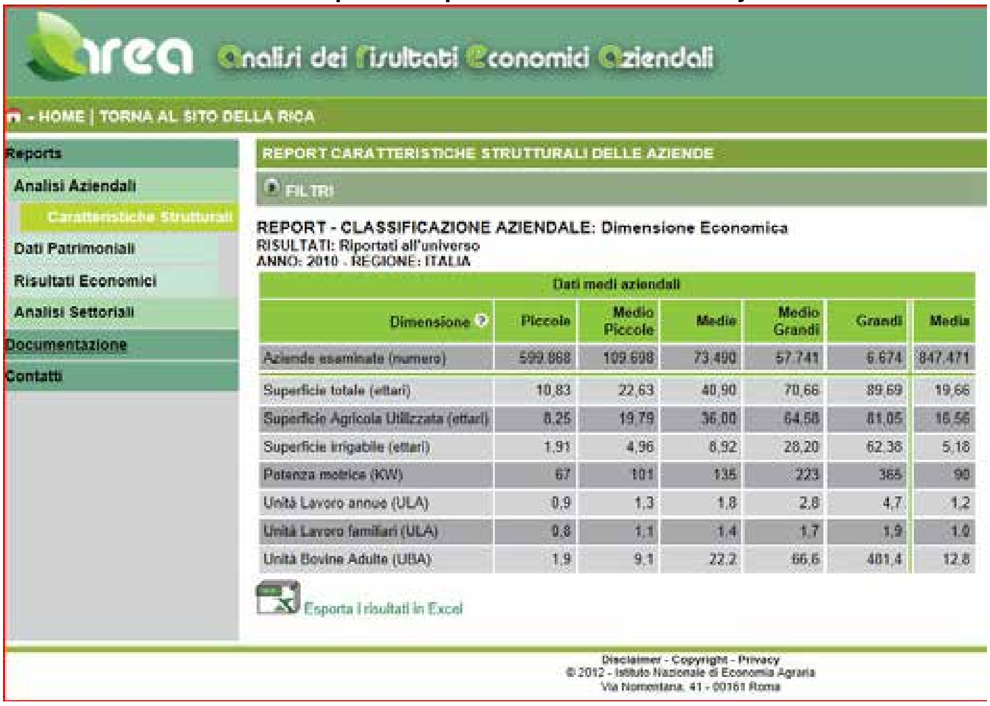
Figure 4 **Dabatase exctracted by EDA**



The main value added of the public database is that by presenting specific cost structure of crop and animal operations, analysts are allowed to investigate on productivity and income related to specific productions.

Moreover the possibility to weight or not to weights results allows differentiation in the analysis, from context analysis to more sophisticated analysis (management, farm viability, forecasting).
The main advantages of such database is that it is easy to be updated, easy to insert new reports, classifiers or variables.

Figure 5 **Database online: an example of a repot of structural variables by Economic Dimension**



REPORT - CLASSIFICAZIONE AZIENDALE: Dimensione Economica
RISULTATI: Riportati all'universo
ANNO: 2010 - REGIONE: ITALIA

Dati medi aziendali						
Dimensione	Piccole	Medio Piccole	Medie	Medio Grandi	Grandi	Media
Aziende esaminate (numero)	599.868	109.698	73.490	57.741	6.674	847.471
Superficie totale (ettari)	10,83	22,63	40,90	70,66	89,69	19,66
Superficie Agricola Utilizzata (ettari)	8,25	19,79	36,00	64,58	81,05	16,56
Superficie irrigabile (ettari)	1,91	4,96	8,92	28,20	62,38	5,18
Potenza motrice (KW)	67	101	135	223	365	90
Unità Lavoro annue (ULA)	0,9	1,3	1,8	2,8	4,7	1,2
Unità Lavoro familiari (ULA)	0,8	1,1	1,4	1,7	1,9	1,0
Unità Bovine Adulte (UBA)	1,9	9,1	22,2	66,6	401,4	12,8

Esporta i risultati in Excel

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Figure 6 Database online: an example of a filtering process

33.5 Challenges

To develop Policy evaluation database
To translate available tools in English
To develop a DWH to customize query
To develop comparison report application
To improve knowledge and uses of FADN to external users

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