PACIOLI 7
Agenda 2000 and the FADN agenda
Workshop report

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- ☐ National and international policy issues
- ☑ Farm Accountancy Data Network; Statistical documentation; Periodical reports

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The PACIOLI network explores the needs for and feasibility of projects on the innovation in farm accounting and its consequences on data gathering for policy analysis in FADNs. PACIOLI 7 was held in the Netherlands in November 1999. This workshop report presents the presented papers. In addition, results of the masterclass on risk analysis are included.

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CONTENTS

Page

Page

Page

Preface

Science has its pinnacles and sometimes comes to a head. PACIOLI 7 was one of the best workshops organised in the series that originally started as an EU AIR supported concerted action (AIR 3-CT94-2456). It was held in the aptly named village of Berg en Dal ('Mountain and Valley') near Nijmegen (the Netherlands) from 7-10 november, 1999.

The interest in the workshop was very satisfactory: a relatively large group, from east and west of Europe, and a good mix of disciplines: researchers using farm accounting data in policy research, researchers interested in farm accounting as a management tool, managers of Farm Accountancy Data Networks (FADNs) and persons involved in the innovation of information systems.

This group produced a large number of interesting papers that supported the discussions well. In addition there were interesting software demonstrations, from Tieto/Enator on their work for DG-Agri and from the LEI on their new ARTIS software for the FADN and managing databases for research. The master class on Risk Analysis was a good method to discuss effects of Agenda 2000 for farm accounting in small groups; it was also a natural follow up of the master class in PACIOLI 6 on data modelling and fitted well into discussions on the EUs FADN control program.

The surroundings of Berg en Dal contributed to the exchange of innovative ideas. That was especially true for the excursion to the Millingerwaard Nature Reserve on the banks of the river Rhine, were the Dutch Ministry of Agriculture, Nature Management and fisheries showed that you can engineer new nature to satisfy the demand for it in a crowded country, just as one can develop a new forest or a new zoo. For some other countries an innovative, and a therefore perhaps a bit shocking, idea.

This book is the workshop report of PACIOLI 7. We would like to thank all the participants: thanks to your enthusiasm the workshop was a success. We would also like to thank Aster Leuftink, who helped Iris de Putter in organising the workshop, and Richard van Hienen and the crew of the LEI's regional FADN office in Huissen for demonstrating ARTIS.

We hope that the readers of this workshop report will find it useful and see it as an invitation to participate in PACIOLI 8.

The managing director,

Prof. Dr. L.C. Zachariasse

Summary

This workshop report is the result of the PACIOLI 7 workshop held in Berg and Dal (near Nijmegen) in the Netherlands. It was one of the best workshops organised in the series that originally started as an EU AIR supported concerted action (AIR 3-CT94-2456). This report is divided in two parts: Masterclass Risk Analysis and Exchanging National Experiences.

Masterclass Risk Analysis

As a natural follow up of the masterclass in PACIOLI 6 on data modelling, this masterclass was dedicated to Risk Analysis. Information systems are developed in several stages. One of the stages deals with the business system design. Based on the information model (data model) from the business area analysis, a detailed design of the procedures and data in a certain area is made. In this stage the assumption of an error-free world is abandoned. A mix of technologies is chosen. To control errors and to check man-machine interaction, handbooks with instructions are written and methods are designed to prevent errors. These aspects are taken into account in designing the system. An important tool in the auditing profession for this activity is Risk Analysis.

The objective of this masterclass was to be able to understand Risk Analysis, to know its place in building information systems and to communicate with experts that can carry out such an analysis. In the first working group session the participants were asked to identify the risks that exist and to name the type of risk. The second step was to identify the causes of risks: what is the reason that a certain risk is present? The last session was dedicated to defining the actions that will be taken to control the risks and keep them at an acceptable level.

Exchanging National Experiences

During the workshop several papers were presented and discussed. A number of papers focussed on Agenda 2000. These include the impacts of Agenda 2000 on German agriculture (Kleinhanß) and the impacts of Agenda 2000 on Finnish agriculture (Lehtonen). San Juan described the profitability of the different European agricultural sectors. French colleagues discussed the need for a reference information system (Del'homme) and the need to produce a general information system (Steffe). Samseth discussed the differences between two accounting principles: tax accounting versus management accounting. Another paper considered the possibilities to use new information on holdings' non-farm activities as a base for classifying the agricultural holdings (Tiainen). The need of accounting data in managerial decision making is discussed by Öhlmér. Poppe described the renewed software for the Dutch FADN that is more flexible and that is able to collect more data than only accounting data. Van Lierde examined in which way the Belgian FADN can be an instrument for

environmental indicators in relation to integrated software to collect accountancy data. Another paper about integration on FADN and environmental indications is using FADN in data management for LCA (Poppe and Meeusen). The collected data can be used as a base for environmental models that helps to estimate the emissions, which are necessary inputs for LCA. Perachino discussed the new financial framework in the Italian FADN. Wauters and Halonen (Tieto/Enator) presented the plans for building a tool to improve the dissemination of results (RICA-3) and the replacement of the EU's software for submitting and checking the national FADN data as an input to DG-Agris FADN database.

How to read this book

This report is the result of the seventh PACIOLI workshop. The workshop was organised around three days of presenting papers, discussing them and discuss related topics. This report is divided in two main parts: Masterclass Risk Analysis (chapter 2 to 5) and Exchanging National Experiences (chapter 6 to 19). The order in which the chapters are given is not totally equal to the order of presentation. Especially the results of the Masterclass have been grouped together.

After the introduction to PACIOLI 7 (chapter 1), the Masterclass Risk Analysis (chapter 2) is presented. This chapter contains the introduction of the Masterclass with the case descriptions and the working groups. Chapter 3 contains the first working group session, Risk Identification. Masterclass Risk Analysis II (chapter 4) was spend on the causes of risks: what is the reason that a certain risk is present? In the third working group session, Methods to control risks (chapter 5), the participants were asked to define the actions that will be taken to control the risks and keep them at an acceptable level.

Chapter 6 to 19 contains the papers presented at the seventh PACIOLI workshop. These can be read in any order. A number of papers focussed on Agenda 2000. These include the impacts of Agenda 2000 on German agriculture (Kleinhanß, chapter 6) and the impacts of Agenda 2000 on Finnish agriculture (Lehtonen, chapter 7). San Juan (chapter 8) describes the profitability of the different European agricultural sectors. Our French colleagues discusses the need for a reference information system (Del'homme, chapter 9) and the need to produce a general information system (Steffe, chapter 10). Samseth discusses the differences between two accounting principles; tax accounting versus management accounting (chapter 11). Another paper considers the possibilities to use new information on holdings' non-farm activities as a base for classifying the agricultural holdings (Tiainen, chapter 12). The need of accounting data in managerial decision making is discussed in chapter 13 (Öhlmér). Poppe describes the renewed software for the Dutch FADN that is more flexible and that is able to collect more data than only accounting data (chapter 14). Van Lierde examines in what way the Belgian FADN can be an instrument for environmental indications in relation to integrated software to collect accountancy data (chapter 15). Another paper about integration on FADN and environmental indications is using FADN in data management for LCA (Poppe and Meeusen, chapter 16). The collected data can be used as a base for environmental models that helps to estimate the emissions, which are necessary inputs for LCA. Chapter 18 discusses the new financial framework in the Italian FADN (Perachino).

The plans for building a tool to improve the dissemination of results (RICA-3) and the replacement of the EU's software for submitting and checking the national FADN data as an input to DG-Agris FADN database are presented in chapter 19 (Wauters and Halonen). Chapter 20 describes the plenary session for all questions and answers the participants would like to discuss. Ideas for a follow up are discussed in chapter 21. In the appendices the address data of the participants of this workshop are presented.

1. Introduction

1.1 The PACIOLI project

This section gives an introduction and some backgrounds of the seventh workshop in the PACIOLI project. PACIOLI started as a concerted action for the EC in collaboration with the RICA/FADN unit. The objective of the concerted action is to explore the needs for and the feasibility of projects on the innovation farm accounting and its consequences for data gathering on a European level through Farm Accountancy Data Networks (FADN). The long-term objective of PACIOLI is to come to an infrastructural network of experts for continuous developments of FADNs. More specific, the concerted action is a step in preparation and development of projects in which information models will be developed that support the development of information systems to improve and extend the RICA/FADN network with various types of data in order to support policy making and evaluation at EU as well as member of state level.

1.2 Previous workshops

The concerted action has already lead to six workshops:

Workshop 1 (March '95, the Netherlands): Introduction and Information Analysis
In the first workshop the concerted action has been introduced and the objectives have been discussed. The need for Strategic Information Management in agriculture has been identified and some experiences with this in various member states were presented. A special focus was on the Dutch experiences with the Information Modelling Programme.

Results were published in:

- Workshop Report: 'Farm accountancy data networks and information analysis' (Mededeling 532);
- Reflection paper: 'On data management in farm accountancy data networks' (Mededeling 533).

Workshop 2 (September '95, the Netherlands): Accounting and managing innovation
In this workshop the process models of the various FADNs have been discussed and compared. With stakeholders' analysis the persons and organisations that are relevant for FADNs have been identified and classified. Discussing recent innovations in the various networks revealed the importance of stakeholders for the PACIOLI project. On the way to innovation the gathering of data on issues like environment and forestry was discussed. In the software field the use of data with a client-server approach using a Windows interface was presented.

Results were published in:
- Workshop Report: 'Accounting and managing innovation' (Mededeling 534);
- Reflection Paper: 'On innovation management in farm accountancy data network' (Mededeling 535).

Workshop 3 (March '96, England): Need for change
In the third workshop ideas for innovation were generated and presented. This process was stimulated by discussions about the effect of new Agricultural Policy, as reflected in e.g. the Fischler paper, on the information requirements of policy makers and thus on the data that should be supplied by FADNs. The rough ideas have been combined and structured, which resulted in 16 project ideas.

Results were published in:
- Workshop Report: 'Need for change' (Mededeling 536);
- Reflection Paper: 'RICA: Reform issues change the agenda' (Mededeling 537).

Workshop 4 (October '96, Italy): Proposals for innovation
In this workshop the project indications of PACIOLI 3 had to be turned into project proposals. A number of problems had to be solved. Based on the discussions in the working groups and the arising consensus, it was decided to split some front office projects, and to cluster some infrastructure projects. As a result the 16 projects were brought back to 13 project proposals.

Results were published in:
- Workshop Report: 'Project proposals for innovation' (Mededeling 538).
- Reflection Paper: 'Proposals for innovation of Farm accountancy data networks' (Mededeling 539).

Workshop 5 (June '97, Sweden) Development of farm accountancy data networks
In this workshop the innovation in the Farm Accountancy Data Network (FADN) of the European Commission has been discussed. The trigger for this theme was an invitation to tender for a feasibility study on the FADNs Farm Return. Special discussions were organised on quality management and the introduction of Internet. The discussions on quality management were based on the process models of FADNs, with reviews of perceived problems by outsiders from other participating countries.

Results were published in:
- Workshop Report: 'Development of farm accountancy data networks' (Mededeling 610).

Workshop 6 (November '98, France): Models for data and data for models
This workshop was mainly dedicated to discuss data models, which are needed for beneficial application of information technology in farm accounting and to use the data successfully in policy research. Also several papers were presented which discussed related issues of Farm Accountancy Data Networks. A number of papers focussed on the use of FADN data in policy-oriented economic models, other papers on the experiences to update the data, the improvement of the performance of an FADN itself and innovations in the Belgian FADN on glasshouse horticulture.

1.3 Programme of the 7th workshop

The theme of the seventh PACIOLI workshop is 'Agenda 2000 and the FADN agenda'.

Monday, 8 November 1999
Masterclass Risk Analysis for data collection I
Identification of all the risks that exist.

Exchanging National Experiences I
'Impacts of Agenda 2000 on German Agriculture- A farm based assessment' (Werner Kleinhanß)
'Impacts of Agenda 2000 on Finnish agriculture - A sector based approach' (Heikki Lehtonen)
'The profitability of the agricultural sectors of the European Union' (Carlos San Juan)
'Relevance in Farm Management diagnosis by a new information approach: towards a reference information system' (Bernard Del'homme)
'Evolution of the farm environment: the need to produce a general information system' (Jerome Steffe)
'Tax accounting versus Management Accounting' (Knut Samseth)
'Census information on non-farm activities as a possible base for classifying the agricultural holdings and possible application of the NACE Rev. 1 to agricultural surveys' (Simo Tiainen)
'Need of accounting data in the managerial decision making process' (Bo Öhlmér)

Towards a new RICA: presentation of prototypes for data exchange and data checking by Tieto Enator Corporation, Public International, Finland
Progress report IASC Exposure Draft Agriculture
Accounting Issues

Tuesday, 9 November 1999
Masterclass Risk Analysis for Data Collection II
Identification of the causes of risks.

'Software for the Dutch FADN as a tool for micro-economic research' (Krijn Poppe).

Presentation and discussion on new object oriented ARTIS for FADN-system at one of the offices of the Agricultural Economics Research Institute in the Netherlands.

Excursion
Millingerwaard - a walk through Dutch foreland

Wednesday, 10 November 1999
Masterclass Risk Analysis for Data Collection III
Define actions that will be taken to control the risks.

Exchanging National Experiences II

'The Belgian FADN as data source for environmental indication' (Dirk van Lierde and Nicole Taragola).

'Using a Farm Accountancy Data Network in data management for LCA' (Krijn Poppe and Marieke Meeusen).

'How to improve the weighting system of EU-FADN results?' (Thierry Vard).

'EC Reg. 1257/99: is it possible to finance farm accountancy?' (Susanna Perachino).

2. Masterclass Risk Analysis: introduction

Krijn J. Poppe

Background

Information systems are developed in several stages (Figure 2.1). One of the stages deals with the business system design. Based on the information model (data model) from the business area analysis, a detailed design of the procedures and data in a certain area is made. In this stage the assumption of an error-free world is abandoned (Figure 2.2). A mix of technologies is chosen. To control errors and to check man-machine interaction, hand books with instructions are written and methods are designed to prevent errors. These aspects are taken into account in designing the system.

An important tool in the auditing profession for this activity is Risk Analysis. In this masterclass we would like to share ideas and experiences on this tool. It can be viewed as a follow up of the successful masterclass in PACIOLI 6, where we exchanged ideas on data modelling in a similar way.

Developing information systems can be divided into four major steps:

- *information strategy planning* (also called a quick scan or a feasibility study). In this stage the mission and strategy of the organisation are translated into the strategy for the information systems. If for instance the analysis of the strategy of DG6 learns that policy topics are changing more rapidly, this asks for more flexible information systems. In the strategy planning stage the major activities (functions) of the organisation are described, as well as the main data items ('objects'), which results in business areas (like data management, policy analysis);
- *business area analysis*: the detailed analysis of all the activities (processes) and data that are part of a certain business area. Central is the 'what-question': what data are needed and what activities are carried out. How this is done (by hand or a computer-device) is not important, and an error-free world is assumed. This makes the analysis easier and results in a model that is stable over time, as it is not dependent on technology but only on the strategy of the organisation in relation to its environment.
  Data modelling is an important tool in this step. In the case of relational data bases a conceptual data model (entity relation diagram) is created.
- *business system design*: a detailed design of the procedures and data in a certain business area, with an expertise available, are important. The 'how-question' is central. Sometimes alternative procedures for the same process are developed (e.g. sending data on paper or by Internet). For computers the system design and the screen dialogue are important issues. For manual tasks, handbooks with instructions have to be written. The assumption of an error-free world is abandoned in this stage, and prevention methods (like control programs, instructions for back ups) are designed for man and machine.
- *technical development and construction* (followed by maintenance): this step involves the realisation with activities like purchasing hard- and software (if available on the market), installing and programming.

Figure 2.1 Stages in the development of an information system

Another reason to choose this topic is that the FADN network is dealing with two areas where this technique could be used. The first one is the gathering of new data to monitor Agenda 2000. In that analysis arguments are put forward that some data can be or cannot be gathered correctly. However not much discussions are held on how to gather the data, and which methods could be used to secure that harmonised data become available for the EU in total.

A second topic is the renewal of the auditing software as such. In this workshop DG6/TietoEnator will present a project on new software to check FADN data. This software will be put into work by defining check points for data control in the software. It is at - the moment - unclear which check points should be included: those from the old software, a new set that results from brainstorming or detected errors? Or a set that is based on a proper risk analysis where a decision is taken regarding the implementation of methods to control risks, based on a cost-benefit evaluation of risk abatement.

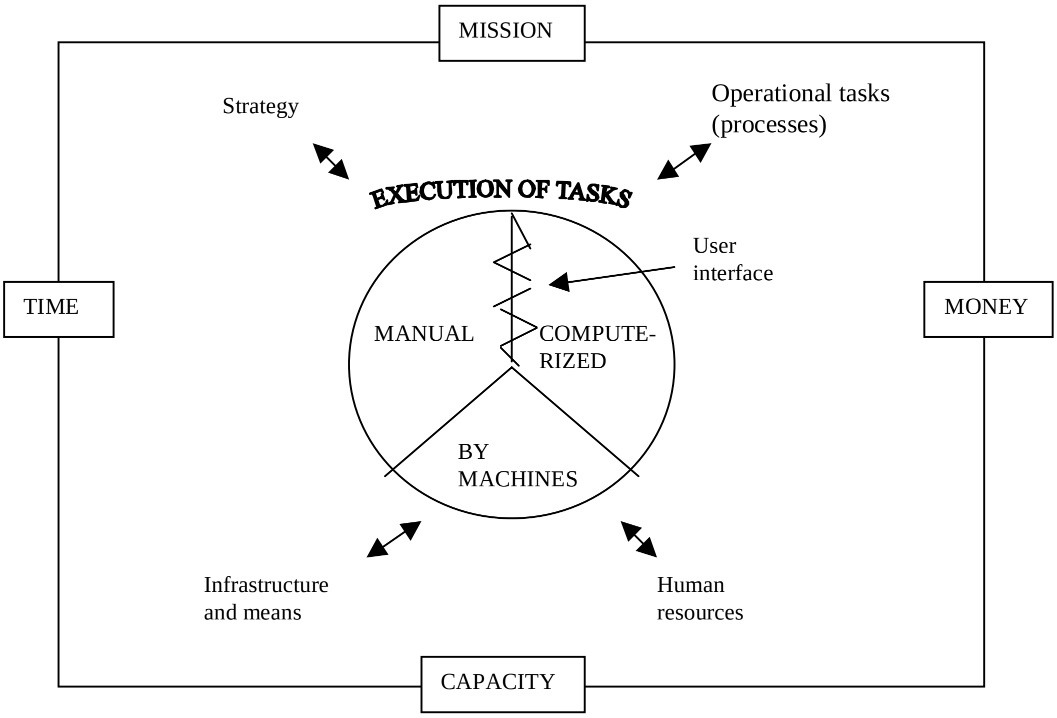

Figure 2.2 Business system design: manual, computer and machine interaction
Source: Vellekoop & Meester, Hoevelaken.

Objective

The objective of the masterclass is to be able to understand Risk Analysis, to know its place in building information systems and to communicate with experts that can carry out such an analysis. It is not our intention to turn you in an expert in a number of hours. But you will learn to be familiar with some key concepts and to be able to judge the usefulness for your own work.

Four cases as a domain

In the masterclass we will use this time 4 different cases, to experience the techniques in different domains. One of the cases is a follow-up of the topic of PACIOLI 6: gather data in an individual farm on gross margins for the farm enterprises (crops, animals). Two others have to do with gathering new data in the FADN to monitor Agenda 2000: data on subsidies on beef, and data on farm tourism (rural development). The last one is gathering accounting data on organic farms.

Case description A: FADN data on beef for monitoring Agenda 2000

The current FADN gathers data on the following types of animals:

Age class (months)	Description
0-4	Calves for fattening (including veal)
5-11	Other cattle younger than 12 months
12-23	Male cattle 12-24 months
	Female cattle 12-24 months that has not yet calved
24 and older	Male cattle 24 months or older
	Breeding heifers
	Heifers for fattening, 24 months or older
	Dairy cows
	Cull dairy cows
	Other cows, including suckler cows

In Agenda 2000 the EU decided to give slaughter premiums for calves being 1-7 months old, and slaughter premiums for cattle 8 months and older. In addition member states are allowed to top up the slaughter premiums for cattle 8 months and older with money from the so called national envelope.

Assume that in the future FADN researchers would like to have the following table with data:

Data on 2001 for farm XYZ

Age class (months)	Description	Number animals	Value of sales sold	Slaugther premiums received		
				number animals	total EU premium	total national envel.
0-4	Calves for fattening (including veal)					
5-11	Other cattle younger than 12 months					
12-23	Male cattle 12-24 months					
	female cattle 12-24 months that has not yet calved					
24 and older	Male cattle 24 months or older					
	Breeding heifers					
	Heifers for fattening, 24 months or older					
	Dairy cows					
	Cull dairy cows					
	Other cows, including suckler cows					

Assume that the accounting organisation that is going to gather the data, intends to take this table to the farmer in order to fill in the cells of the table. The data will be taken as much as possible from the invoices that farmers receive from their slaughterhouse and from the national organisation that pays out subsidies. These documents contain data on the number of animals sold/receiving a premium and on the value.

Take for the risk analysis the point of view of the FADN user in Brussels: so what can go wrong in gathering the data and converting it to Brussels into a table that provides a representative table on EU level?

Case description B: FADN data on farm tourism

Rural development is an interesting issue. In some regions (like mountain areas in Austria or the south of France) farmers earn money by selling tourist services. In addition the farmers receive subsidies to maintain the countryside. In a farm that the FADN committee recently visited in the South of France, and FADN farmer received more subsidies on his sheep than his income from sheep farming. This was justified by the need to maintain the landscape in the mountainous area, and to promote tourism, on his own farm as well as in the valley. The income from tourism however was not reported in the FADN. It was also unclear how much the local tourism industry benefits from the services provided by the farming community in the form of landscape maintenance.

Assume that, to get a better understanding of the economics of farm tourism, the FADN would like to gather the following data:

Data on Farm XYZ, 2001

Variable to be gathered	Numbers or amount in Euro
Total output (gross income) from tourism	
Costs made for tourism	
Net income from farm - tourism	
Total number of tourist - nights in the farm (in case of guest houses, campings etc. only)	
Total number of tourist - nights in the village	

Assume that the local accountant that gathers the data gets the data from the farmer (by making his accounts or asking an estimate for the number of overnight stays) and that the number of overnight stays in the village is known by the local Tourist Information.

Take for the risk analysis the point of view of the FADN user in Brussels: so what can go wrong in gathering the data and converting it to Brussels into a table that provides a representative table on EU level?

Case description C: Farm level data on gross margins

Cost of production is an interesting issue. Gross margins can help to understand the variable costs of an enterprise (crop, animals) and understand its profitability. In analysing the Common Agricultural Policy there is a big demand for this data.

Assume that, to get a better understanding of the economics of gross margins, the FADN would like to gather the following data on crops:

Data on Farm XYZ, 2001

Variable to be gathered	Amount in Euro per ha			
	wheat	sugar beets	etc.	total for all crops
Total output (gross income) from crops				
Fertiliser costs				
Costs of pesticides				
Other direct, variable costs				
Gross Margin				

Assume that the local accountant that gathers the data, gets the data from the farmer (by making his accounts and asking an estimate for allocation of specific, direct costs to the crops).

Take for the risk analysis the point of view of the accountant that asks the data from a number of farms: so what can go wrong in gathering the data and compare them between farms?

Case description D: FADN data from organic farms

Organic farming is, at least in some countries, an important type of farming. Subsidies are given to farmers that convert their farm into an organic farming operation. Farmers have a lot of interest to learn if organic farms are more profitable than traditional ones.

Assume that, to get a better understanding of the economics of organic farming, the FADN would like to gather the following data on every farm in the FADN:

Data on farm XYZ, 2001

Variable	Number/amount
Type of farm: 1= normal, 2 = organic, 3 = in conversion	
Weighting factor for the farm to represent the field of survey	
In addition all the normal FADN data are gathered.	

Assume that the local accountant that gathers the data, gets the data from the farmer and that the national FADN calculates the weighting factor for the member state.

Take for the risk analysis the point of view of the FADN in Brussels that has to guarantee that a table calculated with this data and weighting, is representative for the situation on organic farming in the EU.

3. Masterclass Risk Analysis I

3.1 Working group session I: Risk identification

Background

The first step of Risk Analysis is the identification of all the risks that exist. The risks are described, and for each risk the type of risk is given. There are three types of risk: the data can be incorrect (E from error), inclomplete (I from incomplete) or not in Time (T). The effects of the risk can be described. To estimate the importance of the risk one has to investigate the chance that the error can be detected (at an early stage), the possibility to repair the error and the financial consequences (high or low).

Instruction

Make a risk analysis for your case by filling in the table that has to be reported. Start with a brainstorm on the risks, and than fill in the other columns.

Table to be reported

Description of risk	Type (E, I, T)	Effects	Traceability (L-H)	Repair possible (L-H)	Financial effect (L-H)

Group composition

FADN data on beef for monitoring Agenda 2000	FADN data on farm tourism	Farm level data on gross margins	FADN data from organic farms
Koen Boone Jerome Steffe Szilárd Keszthelyi Clemens Hüsgen Heikki Lehtonen Bo Öhlmér	Carlos San Juan Nicole Taragola Edina Czegai Sven Kleppa Alexander Solomon Yves Plees	Bernard Del'homme Werner Kleinhanß Zsolt Balogh Susanna Perachino Krista Kõiv Knut Samseth PilarSantamaria	Dirk van Lierde Tommy Burke Iraj Namdarian Hans-Hen. Sundermeier Dragi Dimitrievski Juan Manuel Intxaurrandieta

3.2 Results

Group I: FADN data on beef for monitoring Agenda 2000

Description of risk	Type (E, I, T)	Effects	Tracea-bility (L-H)	Repair possible (L-H)	Financ. effect (L-H)	Causes	Chance (L-M-H)
Number of animals sold is incorrect	E	Not possible to calculate % animals with premiums	H	H	H		
Slaughter premiums are recorded in wrong class of animals	I, E	- wrong conclusions in research - differences with IASC data	L	H	H		
Data on premiums available too late	T	Analysis made are based on old data	H	L	H		
Data on EU payments and national envelope cannot be split in accounts	I	- analysis on national support can not be done - mistrust between m. States	H	H	H		

Group II: FADN data on farm tourism

Description of risk	Type (E, I, T)	Effects	Tracea-bility (L-H)	Repair possible (L-H)	Financ. effect (L-H)	Causes	Chance (L-M-H)
Data on tourism is missing on farms with tourism	I	No research can be done	H	H	L		
Data on output and income is wrong	E	Wrong conclusion on income from tourism	L	L	L		
No information on number of tourists in farm	I	Less research available	L	L	L		
No data on night is village or too late	I, E, T,	Less research can be done	H	H	L		

Group III: Farm level data on gross margins

Description of risk	Type (E, I, T)	Effects	Tracea-bility (L-H)	Repair possible (L-H)	Financ. effect (L-H)	Causes	Chance (L-M-H)
Output in euro per crop is estimated wrong per crop	E	- gross margins are not correct - conclusions on improvement farm income are wrong	H	H	H		
Subsidies per crop are missing (come too late e.g. oil seeds)	T, E, I	- output and gross margins are not correct - data comes too late available	H	H	H		
Allocation of variable costs per crop do not add up to total farm level; allocation is wrong	E, I	- studies on costs and environmen-tal impact cannot be made - gross margin wrong	H	H	H		

Group IV: FADN data from organic farms

Description of risk	Type (E, I, T)	Effects	Tracea-bility (L-H)	Repair possible (L-H)	Financ. effect (L-H)	Causes	Chance (L-M-H)
Type of farming is not correctly defined	E	- wrong conclusions in comparing organic/non-or-ganic farms - wrong weighting	L	H	H		
Organic farms are differently defined between member states (lack of harmonisation in EU)	E, I	- wrong conclusion in comparing m.s. - wrong conclusion on importance of org. farms	L	H	H		

Description of risk	Type (E, I, T)	Effects	Tracea-bility (L-H)	Repair possible (L-H)	Financ. effect (L-H)	Causes	Chance (L-M-H)
Organic farms below FADN threshold are included (higher sgm ?)	I	wrong conclusions in comparing of farms	L/H	H	L/H		
Mixed farms (organic/no organic products) are wrongly classified	E	comparability	L	L	H		
Wrong weights organic farms	I	wrong conclusions on representativity	L	L	H		

4. Masterclass Risk Analysis II

4.1 Working group session II: Causes of risks

Background

The second step of the Risk Analysis is to identify the causes of the risks: what is the reason that a certain risk is present ? This is done by adding two columns to the table from the previous step and list a number of causes for each risk. In addition an estimate is made of the chance that the risk will appear and the effects become a reality.

Instructions

Review the risks that the previous group identified and add to the table the causes and chance of appearance (High - Medium - Low).

Table to be reported

Description of risk	Type (E, I, T)	Effects	Tracea-bility (L-H)	Repair possible (L-H)	Financ. effect (L-H)	Causes	Chance (L-M-H)

Group composition

FADN data on beef for monitoring Agenda 2000	FADN data on farm tourism	Farm level data on gross margins	FADN data from organic farms
Koen Boone Nicole Taragola Zsolt Balogh Knut Samseth Edina Czegai Iraj Namdarian	Carlos San Juan Werner Kleinhanß Szilárd Keszthelyi Hans-Hen. Sundermeier Tommy Burke Susanna Perachino	Bernard Del'homme Sven Kleppa Clemens Hüsgen Bo Öhlmér Juan Manuel Intxaurrandieta Dragi Dimitrievski	Dirk van Lierde Alexander Solomon Jerome Steffe Krista Kõiv Pilar Santamaria

4.2 Results

Group I: FADN data on beef for monitoring Agenda 2000

Description of risk	Type (E, I, T)	Effects	Traceability (L-H)	Repair possible (L-H)	Financ. effect (L-H)	Causes	Chance (L-M-H)
Number of animals sold is incorrect	E	Not possible to calculate % animals with premiums	H	H	H		
Slaughter premiums are recorded in wrong class of animals	I, E	- wrong conclusions in research - differences with IACS data	L	H	H		
Data on premiums available too late	T	analysis made are based on old data	H	L	H		
Data on EU payments and national envelope cannot be split in accounts	I	- analysis on national support cannot be done - mistrust between m.states	H	H	H		

Group II: FADN data on farm tourism

Description of risk	Type (E, I, T)	Effects	Traceability (L-H)	Repair possible (L-H)	Financ. effect (L-H)	Causes	Chance (L-M-H)
Data on tourism is missing on farms with tourism	I	no research can be done	H	H	L	1.prevent records => save t. 'black/ grey economy 2.definition of accounts	L...H (depends on country size of operation)
Data on output and income is wrong	E	wrong conclusion on income from tourism	L	L	L	see above 1. and 2.	L...H (depends on country size of operation)

Group II: Continue

Description of risk	Type (E, I, T)	Effects	Tracea-bility (L-H)	Repair possible (L-H)	Financ. effect (L-H)	Causes	Chance (L-M-H)
No information on number of tourists in farm	I	less research can be done	L	L	L	no registration. See 1. Data collection difficult	L...H (depen-ding on region and sub-sidies)
No data on night is village or too late	I, E, T	less research can be done	H	H	L	connection to tourist is missing	L...H (depen-ding on region and sub-sidies)

Depending on operation type: - camping sites (places/persons)? - apartments (persons/no overnight stay/no bed).

Group III: Farm level data on gross margins

Description of risk	Type (E, I, T)	Effects	Tracea-bility (L-H)	Repair possible (L-H)	Financ. effect (L-H)	Causes	Chance (L-M-H)
Output in Euro per crop is estimated wrong per crop	E	- gross margins are not correct - conclusions on improvement farm income are wrong	H	H	H	- absence of data - lack of defini-tion on gross margins - difference in measurements	
Subsidies per crop are missing (come too late e.g. oil seeds)	T, E, I	- output and gross margins are not correct - data comes too late available	H	H	H	- data comes too late	
Allocation of variable costs per crop do not add up to total farm level; allocation is wrong	E, I	- studies on costs and environmen-tal impact can not be made - gross margin wrong	H	H	H	- some costs are difficult to allocate correct at farm level - unwillingness from the farmer - lack of harmoni-sation between methods	

Group IV: FADN data from organic farms

Description of risk	Type (E, I, T)	Effects	Tracea-bility (L-H)	Repair possible (L-H)	Financ. effect (L-H)	Causes	Chance (L-M-H)
Type of farming is not correctly defined	E	- wrong conclusions in comparing organic/ non-organic farms - wrong weighting	L	H	H	not correctly defined	H
Organic farms are differently defined between member states (lack of harmonisation in EU)	E, I	- wrong conclusion in comparing m.s. - wrong conclusion on importance of org. farms	L	H	H	are defined between member states	H

Description of risk	Type (E, I, T)	Effects	Tracea-bility (L-H)	Repair possible (L-H)	Financ. effect (L-H)	Causes	Chance (L-M-H)
Organic farms below FADN threshold are included (higher sgm ?)	I	wrong	L/H	H	L/H	lack of quality information in national census	H (lack of SGM)
Mixed farms (organic/no organic products) are wrongly classified	E	comparability	L	L	H	lack of allocation between organic + non organic enterprises	H (lack of SGM)
Wrong weights organic farms	I	wrong conclusions on representativity	L	L	H	lack of good typology	H (lack of SGM)

Political interference?

5. Masterclass Risk Analysis III

5.1 Working group session III: Methods to control risks

Background

The third and last step of the Risk Analysis is to define the actions that will be taken to control the risks and keep them at an acceptable level. Risks cannot be ruled out totally and in essence this is a cost/benefit analysis.

For each cause of risk a number of actions or methods to control risks can be taken. This is done per cause, as a number of actions to take away or reduce the effects of one cause (e.g. inexperienced accountant, unclear instructions) can reduce more than one risk, making it more cost effective.

Instruction

Review the risk analysis carried out in the previous 2 groups brainstorm on the potential action that can be taken to reduce the risks to an acceptable level. Then decide if such an action should be taken or not in this case.

Table to be reported

Cause of risk	Risk	Actions that can be taken	Taken yes/ no (Y/N)

Group composition

FADN data on beef for monitoring Agenda 2000	FADN data on farm tourism	Farm level data on gross margins	FADN data from organic farms
Koen Boone	Carlos San Juan	Bernard Del'homme	Dirk van Lierde
Tommy Burke	Jerome Steffe	Szilárd Keszthelyi	Bo Öhlmér
Sven Kleppa	PilarSantamaria	Iraj Namdarian	Werner Kleinhanß
Krista Koiv	Clemens Hüsgen	Nicole Taragola	Dragi Dimitrievski
Alexander Solomon	Zsolt Balogh	Thierry Vard	Edina Czegai
Susanna Perachino	Juan Manuel Intxaurrandieta	Hans-Hen. Sundermeier	Knut Samseth

5.2 Results

Group I: FADN data on beef for monitoring Agenda 2000

Cause of risk	Risk	Actions that can be taken	Taken yes/no (Y/N)
No split on invoices between EU and national premiums	- data on EU and national premiums cannot be split	- additional Q on form - accdundant instructions - request ms to split - accept no split	
No split on invoices for premiums per type of animals	- slaughter premiums for in wrong class of animals - data on number of animals that received premiums are incorrect	- EDIT form (harmonise info gathering) - request split by farmer	
Farmer gives wrong data (on purpose)	- data on number of animals incorrect - data on premiums received per class of animals are wrong	- assure farmer (i.e. TAX) - cross checks	

Group II: FADN data on farm tourism

Cause of risk	Risk	Actions that can be taken	Taken yes/no (Y/N)
Farmer does not keep records on tourism to prevent tax	- data on tourism is missing on farms with tourism - data on output and income are wrong	- tax control - control reservation - new detailed farm return - (maybe from other way collect some data) - bonus for right data	N Y Y/N
Farmer is not willing to register data on number of tourist (nights) in farm	- no information on number of tourists in farms	- get some extra data and/or - some extra estimations (not necessary from the farm level)	Y
Farmer provides data on capacity (number of camping sites, apartment beds) in stead of real sold nights	- no information on number of tourists in farms	educate the farmers trainings	Y

All causes of risks:	Yes/No (Y/N)
Have to proof to farmers this data will be useful for their accountancy	Y
Get the data from directly the client	

Group III: Farm level data on gross margins

Cause of risk	Risk	Actions that can be taken	Taken yes/no (Y/N)
Lack of harmonised definitions on gross margin	- output in Euro per crop is estimated wrong - allocation of variable costs is wrong	- analyse differences co-exits member states definitions - develop definitions on EU level - harmonise definition	
Data comes too late	- subsidies per crop are missing	- more an estimation	
Unwillingness of farmer to record use of inputs per crop	- allocation of variable crops is wrong - gross margins are not correct	improve the feedback	

Group IV: FADN data from organic farms

Cause of risk	Risk	Actions that can be taken	Taken yes/no (Y/N)
Organic farming is not correctly defined	- Type of farming wrong - different definitions between m. States - mixed farms (organic/non-organic) wrongly classified	- better instructions - the same good definition in every country	Y
Lack of good typology	- wrong weighting	- good typology - not necessary based on SGM	Y
Lack of census information	- organic farms below threshold are included - wrong weighting	- adapted census to collect data on organic farms	Y
Lack of sgm	- wrong weighting - organic farms below threshold are included	- adapted FADN and calculation of SGM	Y

6. Impacts of Agenda 2000 on German agriculture - a farm based assessment

Werner Kleinhanß [1]

Abstract

The objective of this paper is to assess the probable effects of Agenda 2000 on German agriculture. Scenarios of the base situation as well as of Agenda cover both, high and low world market prices for cereals; price variations for oilseeds and modified measures are considered, too. A farm model is used to assess changes in agricultural production and income, taking into account the structural characteristics of farming, natural conditions and farmers' adjustments. Results show that there will be a significant shift in arable crop production in favour of cereals and a reduction of beef production. Income effects are mainly determined by price changes, by deficient compensation payments and premium restrictions either at regional, process or farm levels.

Keywords: Policy Assessment, Common Agricultural Policy

6.1 Introduction

Principles of Agenda 2000 are a further market liberalisation by means of reducing intervention prices and the stabilisation of farm income by direct payments either partially decoupled or coupled with production. It will be introduced between 2000 and 2007/8; the reforms in the arable crop and beef sectors will be realised in the first years while the main changes of the dairy regime will come into force after 2005. The regulations are rather complex; especially beef premia have to be adjusted with regard to budget constraints and member states have to decide either if national envelopes of beef premia will be transformed into grassland premia or if direct payments will be restricted by the principles of 'modulation' or 'cross compliance'. Allocation, intensity and size of production as well as farm income will be affected. Farmers have to decide on optimal strategies due to further changes of economic condition.

A system of complementary models has been developed by the FAL institutes in collaboration with IAP [2] and FAA [3] with the aim of quantitative policy assessment. It consists of a partial equilibrium market model (GAPsi) for the EU, a regionally differentiated optimisation model for the German agricultural sector (RAUMIS), an optimisation model

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for representative farms (BEMO) and a simulation model for typical farms (TIPI-CAL). The models are used interactively. The aim of this approach is to assess impacts of policy changes at market, regional and farm level, to determine the main influencing factors e.g. on supply and income and to work out proposals for modifications of policy instruments.

The paper focuses on the farm level approach, starting with the principles of the model, data and scenarios. The main changes in the arable crop, beef and dairy sector as well as the impacts on farm income for different farm types locations and sizes will be described.

6.2 Models and scenarios

The model BEMO is a one-periodic optimisation model for individual farms, based on Linear Programming. The model system consists of a calculation scheme for input and output coefficients, a matrix generator and an LP-solver. Input and output coefficients are either taken directly or exogenously calculated on the base of farm accounting data of Land Data, statistical data and normative data from farm management handbooks. As far as possible they are defined in consistence with farm accounts. The matrix is defined in EXCEL spreadsheets; with the help of macros, input/output coefficients of the standard matrix are modified in consistence with individual farm data. The model is solved with the spreadsheet connected solver XA [1]. The output is processed with statistical and plot routines.

This model includes the most important production activities excluding horticultural and forestry production. All market and price policy measures of CAP'92 and Agenda 2000 are specified in detail. Mixed-integer specifications are used to allow alternative adaptation strategies, as for example the application of the small producer schemes, livestock extensification schemes and minimum set-aside.

The assessment is based on 833 farms in West Germany and on 140 farms in the New Federal States. The sample of the western part represents a farm structure forecast for the year 2005, referring to farm type, size and location. Due to the formerly proposed digressive payment scheme, farms larger than 500 ha are over-represented in East Germany. Farm individual weighting factors are not yet introduced, therefore a sectoral aggregation is not possible. A consistent aggregation scheme will be introduced next time when the model will be modified towards the data base of the national farm accounting system.

Scenarios are defined based on simulations of the market (GAPsi) and regional models (RAUMIS). Because of major uncertainties with respect to the development of future world commodity prices, two series of model calculations are carried out considering either high or low world prices:

- scenario *base-one* refers to baseline projections by OECD and FAPRI (OECD, 1998; FAPRI, 1998; USDA, 1998) assuming world market prices for wheat above the actual EU intervention price. On this condition, EU wheat can be exported to world markets without subsidies since GATT export restrictions do not come into effect. Obligatory set-aside can be reduced to 5% of the base areas (considered to be the

[1] Sunset Software Technology, San Marino, California.

minimum rate). Coarse grains' exports are within GATT limits. The oilseeds' area must be kept to 10% of the base areas;

- scenario *base-two* centres on world cereal prices ranging below EU intervention levels. Such prices were observed in 1998 and before 1996 (FAPRI, 1997). EU market prices are stabilised by intervention and exports are subsidised. In order to comply with GATT restrictions EU cereals' production has to be controlled by obligatory set-aside at a rate of 27% of the base area. The guarantee area for oilseeds has to be reduced by the same rate.

The *Agenda 2000* scenarios principally include the measures defined in the final decisions, i.e. price reductions in the cereals', beef and milk sectors, acreage payments for arable crops (depending on price changes of cereals), set-aside, increased headage payments for male beef cattle and suckler cows, new payments for dairy cows, heifers and calves. Beef payments are determined within the limits of national envelopes. Supplementary to the changes in intervention prices two different levels of market prices, a higher one and a lower one, have been assumed for cereals. Based on calculations from GAPsi there is no need for an obligatory set-aside in the first case, whereas in the second a 5% set-aside rate is necessary in order not to get into conflict with GATT restrictions for cereals.

In the following, impacts of Agenda are compared to the scenario base-one with 5% set-aside; only for income effects other scenario conditions are taken into account.

6.3 Impacts of Agenda on land use and livestock production

Arable crops

Reforms in the arable crop sector include the reduction of intervention prices of cereals by 15%, homogeneous area premia based on reference yields of cereals and obligatory set-aside. Within two years premia for oilseeds will be lowered to the level of cereals and in the final stage it is assumed that guarantee areas fixed within the Blair-House agreement will be abandoned. That means that premia restrictions for oilseeds which in the New Federal States are determined at 6 to 18% of base area will not exist anymore.

In the arable crop sector mainly cereals, oilseeds, protein crops and set-aside will be affected by economic conditions of the Agenda. The general economic conditions of Agenda are comparable with those of the small producer scheme of CAP'92. All those crops and activities formerly favoured by high compensation payments will be negatively affected by the reduced level of acreage based payments. The main changes are:

- the Agenda proposals go at the expense of set-aside. Positive allocation effects derive from these changes;
- the relative competitive position of cereals improves through the conformity of payments within the arable crops regime. The production of cereals rises by 13% at sectoral level. In West Germany the grain area is to expand strongly especially on larger farms. Since a majority of small farms is already using the small producer scheme in the base scenario most adjustments in the arable crop sector have already

taken place. The high share of cereals in arable land illustrates that a more homogeneous crop rotation is to be expected;
- production of forage maize will be reduced by 5 and 8%, mainly related to changes of beef production.

Competitiveness of *rape seed production* is, above all, determined by the price, the premia and the yield relationship with cereals. During the first two years oilseed premia are still based on regional reference yields for oilseeds and a bonus on cereal subsidy. Food-oilseed area will be reduced by about 10% in the first year, and 20% in the second; there are no significant differences between the regions (see Figure 6.1).

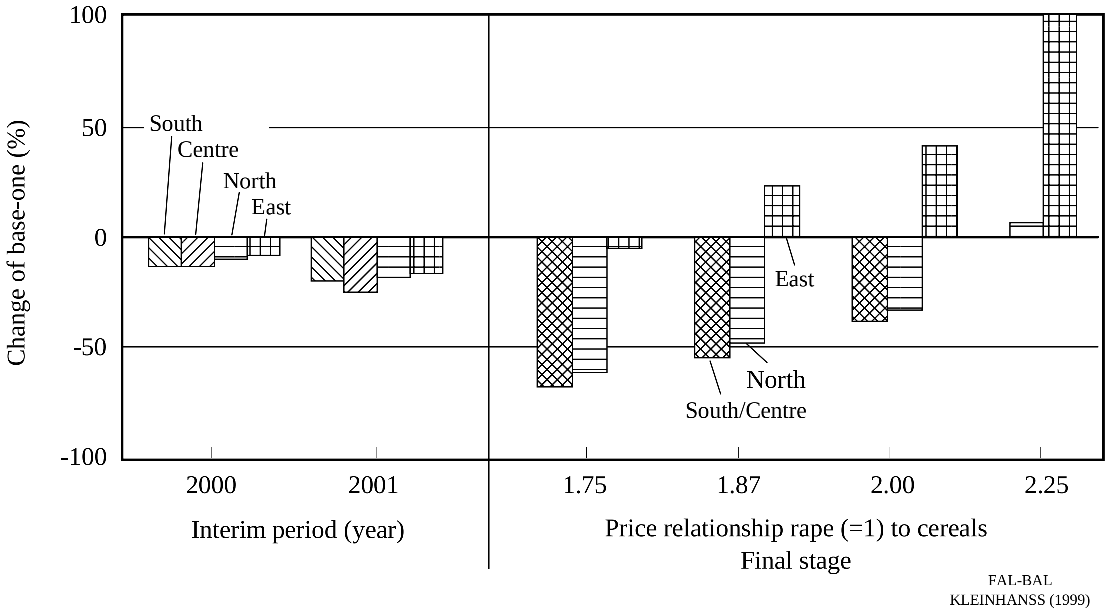


Figure 6.1 Change of food-rape see in Agenda

In the final stage there will be a significant reduction of oilseed areas in the western part and an increase in the eastern part of the country. This adaptation mainly depends on the price relationship of rapeseed with cereals. The actual level of production will be reached with price relations of about 2.2 in the western part or of 1.8 in the eastern part. Reasons are that in the base situation oilseed areas in the eastern part were restricted by guarantee areas such that production was much below the optimal level. Without these restrictions on the one side, but equal premia for all arable crops on the other, production potentials will be mobilised under condition of Agenda in the New Federal States. Compared to the former scheme preferring less favoured areas, oilseed production will be concentrated on high-yield regions in future.

Non-food-oilseeds will be produced as long there is a mandatory set aside and as long as seed prices are in the range of 300 DM/t.

Beef production

The reforms in the beef sector already start in 2000; the guarantee prices were reduced stepwise, up to 2003 by 20%. Beef premia consist of three components (EU basic premia, a slaughtering premia and a national supplementary payment). Due to national plafonds we expect that premia for male cattle in Germany should have to be reduced by 40 Euro. Supplementary bonuses can be reclaimed for extensive livestock holding systems.

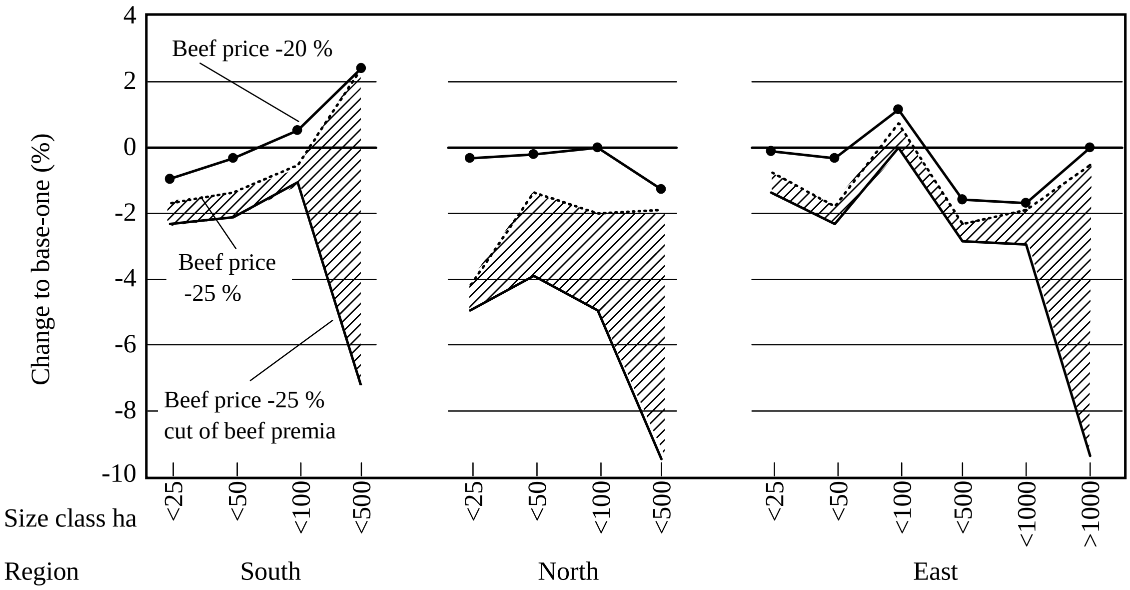
The economics of beef production mainly depend on price changes and premia. Under conditions of 20% lower prices in the final stage and no cut of premia, gross margins do not change at all. With price reductions of 25%, which seems to be possible within the new scheme, production will be reduced by about 2% on the average. If there is an additional reduction of premia, beef production will decrease by 4%.

There are considerable differences between small and large farms and regions (see Figure 6.2). Under conditions of 20% lower prices without a cut of premia, large farms in the south even increase beef production up to 2%. This might be due to overcompensating premia, but also by the fact that the ceiling for 90 male beef will be abandoned. There is an under compensation of output changes if prices are reduced by 25%. Small farms in the south and east reduce beef production by about 2%; in the north changes are even stronger. If the EU-basic premia for male beef is reduced by 40 Euro due to national plafonds, there will be a significant under compensation and hence a reduction of beef production especially in large farms. This problem can partly be overcome by the change towards less intensive production systems for which additional premia can be reclaimed. To reach density limits of 1.6 or 1.4 LU/ha of roughage area, beef stock has to be reduced. Due to this adaptation large sized farms reduce beef production by up to 10%. It is an open question if these changes towards extensive systems will be in line with the quality requirements of the consumers.

Based on the results, it can be concluded that beef production much more depends on the level and specification of headage premia. The application of headage premia will become much more favourable than area payments for forage maize, and in most cases beef production without premia will not be competitive anymore. The beef regime will increase the intensity of policy interventions and will lead to high administrative efforts and increasing budgetary costs.

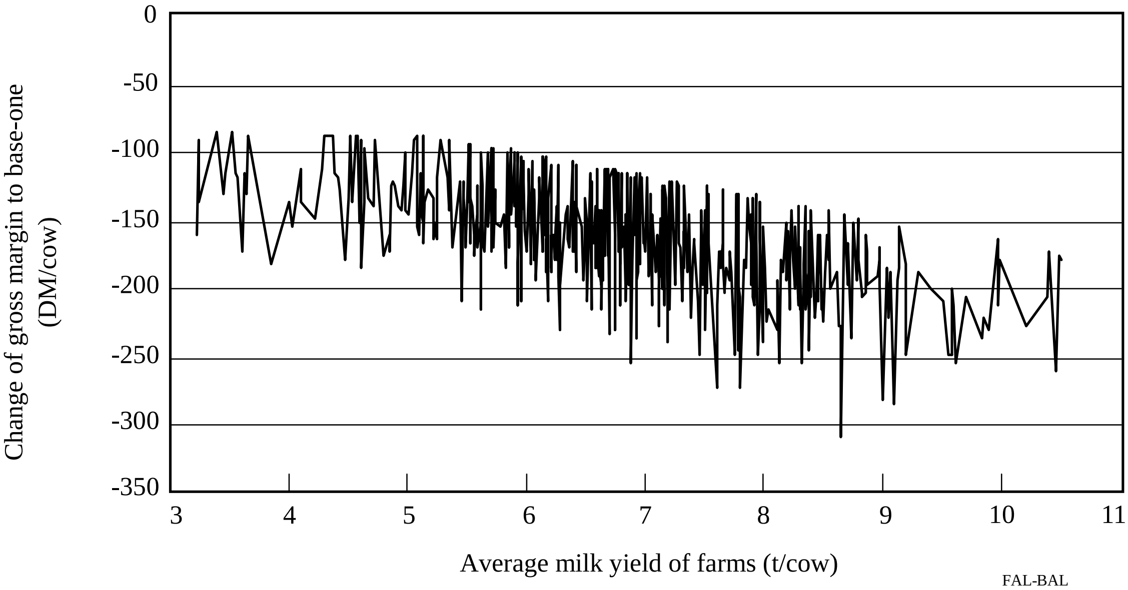
Milk production

The reform of the milk market regime will be introduced between 2005/06 to 2007/08, when milk prices are reduced stepwise by 15% and quota are increased by 1.5%. Supplementary quota of 1.2% in 2000 for southern countries and Northern Ireland will induce pressures on milk prices such that income losses in other EU-countries can be expected. Even in the final stage, output reductions due to lower milk prices will only be covered by dairy premia by about 2/3, therefore income losses in milk production will be induced (Figure 6.3). Nevertheless, milk production still is competitive such that it will be adjusted in the range of additional quota.



FAL-BAL
KLEINHANSS (1999)

Figure 6.2 Change of beef meat production in Agenda



FAL-BAL
KLEINHANSS (1999)

Figure 6.3 Income effects of Agenda (final stage) on milk production

Compensation payments are coupled with milk quota. Less decoupled payment schemes like dairy cow premia or grassland premia would be much more favourable with regard to the end of the quota scheme by 2008.

Compensation payments are coupled with milk quota. Less decoupled payment schemes like dairy cow premia or grassland premia would be much more favourable with regard to the end of the quota scheme by 2008.

6.4 Income effects of Agenda 2000

The income effects of Agenda are determined by several factors, i.e. price changes, the level and type of compensation, budget constraints, ceilings for transfer payments and last but not least adjustments at farm level. In the following we will distinguish between a) the stepwise introduction of the regimes between 2000 and 2007/08, and b) the final stage being projected to the year 2005. For a) we assume market price changes of cereals equal to the reduction of intervention prices, while for beef and milk prices we take into account alternative options.

Referring to a) there will be a reduction of gross margins by 4% in cropping farms even in the first year (see Figure 6.4). Due to further price reductions and 'under compensating premia' there will be income losses of 7% in the second year. For mixed farms gross margins will be continuously reduced between 1 and 5% during the whole period. Pig and poultry farms will have income losses between 2.5 and 5%, while the income development is rather the same as the one of cropping farms.

There will be a fundamental difference of income effects for dairy and beef farms. During the first years, they will get higher income, if market prices of beef are equal to changes of intervention prices and if milk prices do not change. If, on the contrary, milk prices are reduced by 2%, beef prices will be lower than the intervention price and if premia for male beef are reduced, income losses of about 2% of gross margins will be induced. From 2005/06 onwards, income of dairy and beef farms will continuously decrease by 5 or 9% in the final stage.

Referring to scenarios of high and low cereal prices (final stage) and different changes of beef prices and premia; Figure 6.5 shows income effects by different farm types, sizes and regions. Under conditions of high prices for cereals and mandatory set

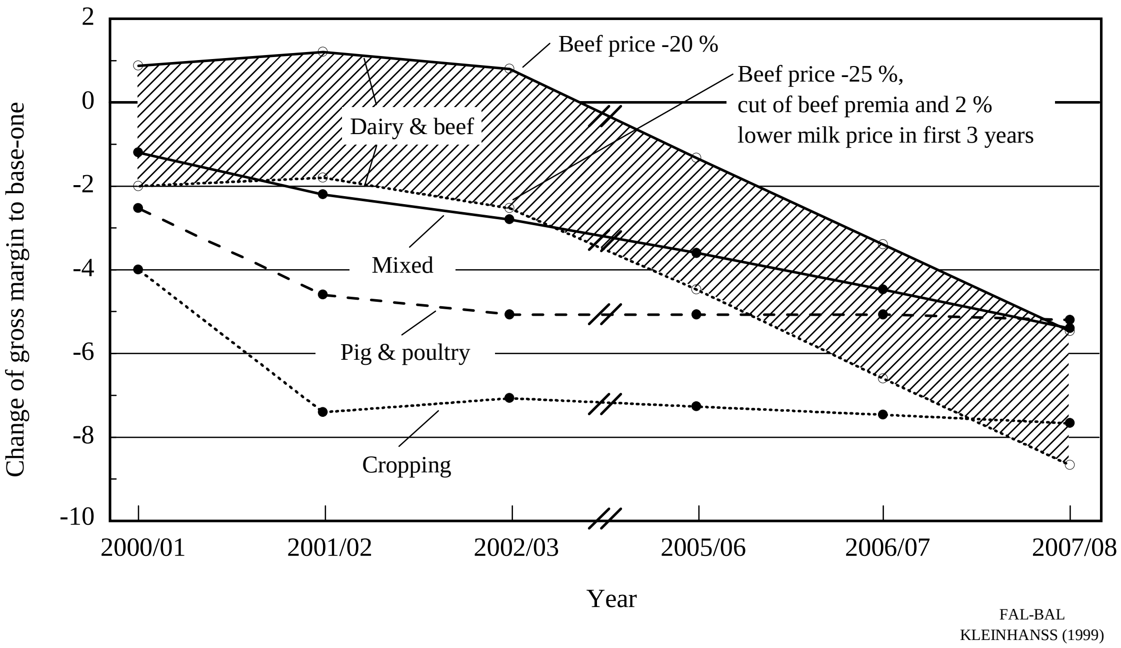


Figure 6.4 Change of gross margins during stepwise introduction of Agenda

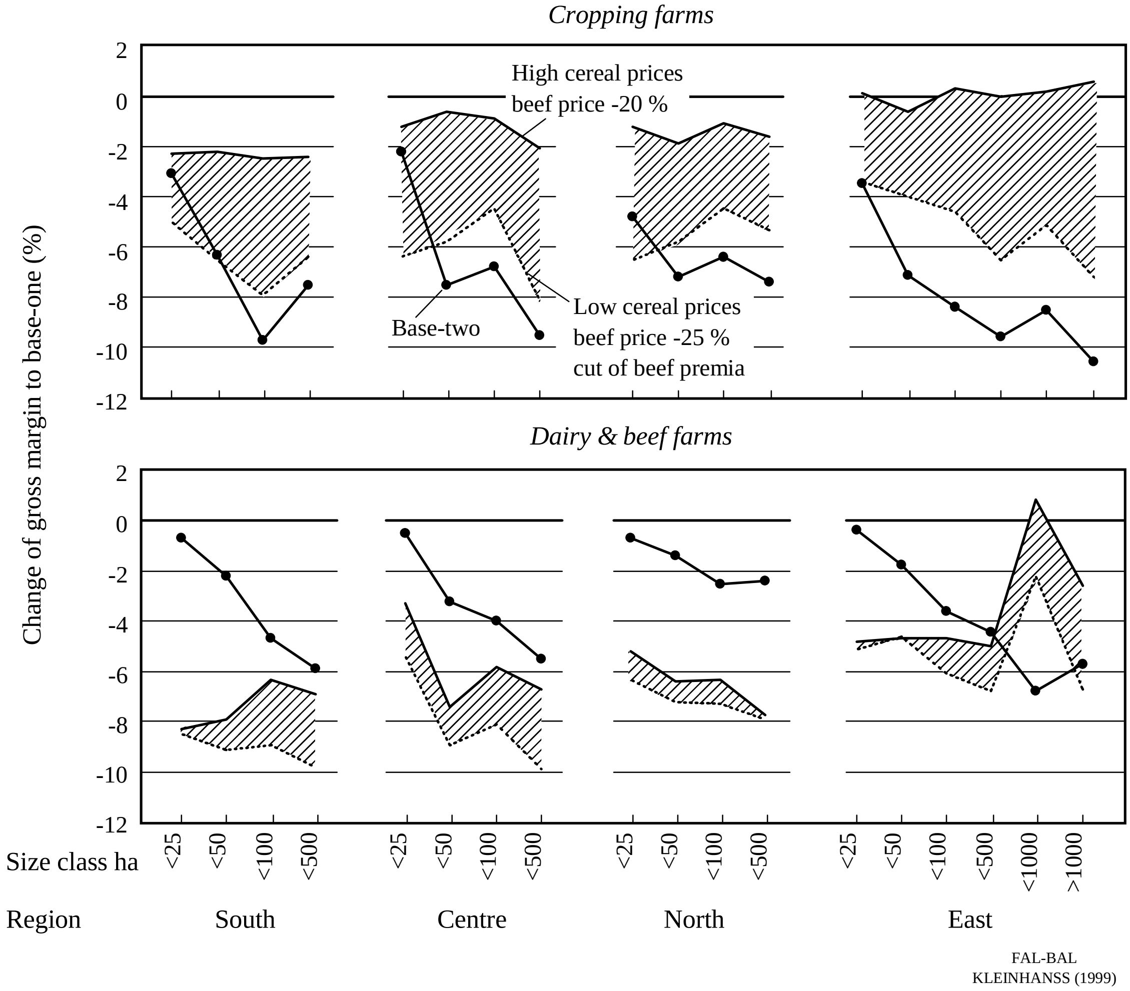


Figure 6.5 Change of gross margins by farm type - final stage of Agenda

aside, *cropping farms* in West Germany will have income losses of 1 to 2.5% of gross margins. They are mainly induced by uniform payments and the resulting adjustment in the arable sector, as well as by income losses in the beef and dairy sector. Large farms in the New Federal States can even realise moderately higher incomes. The outcome of the final decision is totally different from the Agenda proposal where large farms would suffer significant income losses due to the degressive payment scheme.

Under condition of unfavourable cereal prices, cropping farms would have significant income losses. Large farms in the New Federal States would be affected more than small ones, while in West Germany no clear tendencies can be identified between farm sizes.

In both scenarios, *dairy and beef farms* would have significant income losses. They are mainly determined by under compensation in the beef sector either by 25% lower beef prices or a cut of beef premia and furthermore by income losses in the dairy sector. Income losses in the west vary between 4 and 10%; in the New Federal States they are in-between 3 and 5% in most size classes.

All the above named income effects are related to base-one-scenario. In Figure 6.5 income changes due to base-two-scenario, assuming low world market prices and a set-aside share of 27%, are also included. First of all, large differences can be considered between small and large farms, but the small farms would undergo only small income changes due to the application of the small producer scheme. On the other hand, large farms would suffer high income losses due to the higher level of mandatory set-aside. Large cropping farms will be better off in Agenda than in base-two-scenario. Dairy and beef farms would have higher income losses in Agenda than without the reform of CAP'92.

6.5 Conclusion

The Agenda 2000 proposals seem to be justified with regard to market liberalisation and a better integration of EU into world market especially in the cereal, oilseed and beef sectors (Tangermann, 1998; Henrichsmeyer, 1998). The regulations for arable crops can be seen as a further step towards de-coupling transfer payments from production. This will increase the chance that transfer payments might fall into the 'Green Box' in the next round of WTO negotiations. Yet, the introduction of uniform payments remains inconsistent as exceptions for pulses, durum wheat and irrigated land persist. The deficient de-coupling of the payments will continue to cause negative allocation effects. Production potentials can be realised especially in the cereal sector taking into account the relatively promising price projections at the world market. It will also avoid miss-allocation of land use due to obligatory set-aside.

However, over-administration especially in the livestock sector will even increase. It is questionable whether such a system can be handled efficiently. One alternative would be a further liberalisation and de-coupling of direct payments.

Although there are still some weaknesses in the modelling approach, it seems to be necessary to go further on in the direction of a complementary framework. In case data are available such a system could be extended to other EU countries.

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7. Impacts of Agenda 2000 on Finnish agriculture - a sector based approach

Heikki Lehtonen [1]

Abstract

Effects of Agenda 2000 CAP reform on Finnish agriculture have been evaluated using a sector level dynamic model. The model simulates agricultural production in different areas of Finland up to 2010. Domestic products and imports are assumed imperfect substitutes. Production technology changes over time in the model through exogenous trends. Feeding of animals changes endogenously in the model. As a result of changing feed use, milk yield of dairy cows changes through estimated milk yield functions.

The results show that Agenda 2000 has a positive effect on milk production in short term because of decreasing grain feed prices. Because of milk price reductions in later years, however, the production volume will fall 10-15% below the national quota level until 2010. CAP reform has no significant effect on pork or poultry production. Grain drying subsidies will slightly increase the grain areas compared to base scenario. The overall grain production volumes and areas, however, will decrease significantly in Finland, especially in northern and eastern parts of the country where a significant share of arable land will become idle. Agricultural income will decrease by 20% in the next ten years despite of relatively rapid improvements in production efficiency.

Keywords: Agenda 2000, Finnish agriculture, policy analysis, sector model, economic adaptation

7.1 Introduction

CAP reform, which is part of the Agenda 2000 agreement, will be one of the most significant changes affecting Finnish agriculture. The effects of the CAP reform, however, are conditional on the national level agricultural subsidies approved by the European Commission. In the year 2000 the support for less favoured areas (LFA) will be extended to cover the whole country. There will be some changes and cuts in environmental subsidy system. In addition, the continuation of a specific subsidy system called 'supports for serious difficulties', which concerns southern part of Finland, is to be decided in the end of this year. Thus, the agricultural subsidy system in Finland will change significantly in the next few years. In this paper, however, only the effects of the Agenda 2000 reform are analysed.

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Consequently, the results to be presented are conditional on the assumptions on the other major issues affecting the agricultural subsidy system.

The structure of the Finnish agriculture is under a rapid change: Many small farms have exit production already while many other farms expand their production. The structural change and changes in production technology are taken into account in the model by introducing different scenarios relating to productivity and production efficiency development.

A dynamic regional sector model of Finnish agriculture (DREMFIA) have been used in preliminary analyses of the impacts of Agenda 2000 on Finnish agriculture. The model simulates agricultural production in different regions from 1995 till 2010. The model provides information on how different agricultural policies affect the level of production and total farm income in different regions in the next ten years. Also policy effects on exports and imports and on self-sufficiency of agricultural products are of importance, as well as environmental effects in different regions. This paper, however, focuses on the effects on production and farmers' income.

The paper is organised as follows. First, the specific modelling approach employed in DREMFIA is introduced. The overall model structure is explained in general terms but no technical description is given. Second, the specific assumptions used in the analysis are briefly presented. The results concerning production and income are presented and discussed. On the basis of the model results, some conclusions are presented on the effects of Agenda 2000 and on the future prospects of Finnish agriculture.

7.2 Dynamic disequilibrium approach

Different approaches used in agricultural sector modelling are reviewed by Bauer and Hendrichsmeyer (1989). The most common model types are sectoral programming models and econometric models. Econometric approach is not easily applicable when examining effects of the agricultural policy in Finland. EU integration caused a great change in economic environment for agriculture. Market prices of agricultural products fell 30-60% overnight 1st January 1995. A complex support system including national direct subsidies and price subsidies was built up.

A widely employed sector modelling approach in agriculture is maximisation of consumer and producer surplus subject to market balance and resource constraints (see, for example, Apland and Jonasson 1992). Using this approach as a starting point a dynamic disequilibrium model has been built. In the following, the basic hypothesis and the structure of the model are described.

There are many reasons why static maximisation of consumer and producer surplus is problematic in modelling Finnish agriculture. The static nature of the model assumes that the base year corresponds to an economic equilibrium. This is not always the case in reality. It is hard to find any such base year in the 1990's that could be understood as an economic equilibrium. Consequently, it is difficult to replicate the base year and to perform agricultural policy analysis.

Economic adjustment to changing agricultural policy may take several years. During this time other changes that are partly independent of the policy may occur. Such changes may happen, for example, in consumption habits of consumers, prices of inputs, crop yield levels, average yields of livestock, and use of some production inputs (e.g. labour and capital) as a result of farm size growth or other rationalisation of production. These changes may strongly affect the direction of development and at least some of these factors should be taken into account in medium and long term policy analysis. This fact has been mentioned in some agricultural modelling applications which are based on static models (see, for example, Apland, Jonasson and Öhlmer 1994 pp. 126-127). However, there have been relatively few efforts to model the internal dynamics or productivity growth of agriculture or farm level adaptation mechanisms. Some efforts in this direction can be found in Bauer 1988, Day 1978 and in Day and Cigno 1978.

Frequent changes in prices, subsidies and technology (this characterise the current economic environment in Finnish agriculture) result in various kinds of adjustment pressures and reactions in agriculture. The market mechanism drives the sector towards equilibrium. However, due to biological and technical constraints as well as fixed production factors and other frictions, the equilibrium is not easily reached. A disequilibrium of a certain degree seems to be typical for Finnish agriculture under changing conditions. Major changes and equilibrium in the agricultural sector are possible if the price relations and policies prevail for an adequately long time.

When creating a dynamic model of agricultural markets different time lags in different lines of production should be modelled. Production cannot change too rapidly because of biological and technical constraints. Also modelling some other special features of agriculture, like feeding requirements and animal and crop yield functions, increases the explanatory power of the model. Including the key driving forces and some specific characteristics and dynamics of agriculture into the same model may bring important insight to economists and policy makers.

7.3 Structure of the model

The basic structure of the model is presented in Figure 7A.1 (in Appendix 7A). A detailed description of the model is given by Lehtonen (1998). A brief description including an environmental application of the model can be found in Lankoski and Lehtonen 1998. A more detailed description of the model in English is available from the author.

No explicit connections to other sectors of the national economy are made in the model. Agriculture is a very small part of the Finnish economy and agriculture has little effect on other sectors. However, direct links from other sectors and from consumers may have a substantial effect on agriculture. Those connections are described implicitly by consumption trends, price elasticity of the demand and the price of labour and other inputs.

The development of the agricultural sector is simulated from 1995 till 2011. The model concerns the most important production lines and includes four main areas. The food consumption and the feeding of animals are determined according to the main areas. The final and intermediate products move between the main areas at certain transportation cost. The production in main regions are further divided to sub-regions according to support zones. In total, there are 14 different production regions. This allows a detailed description of agricultural policy measures and production technology.

7.3.1 Optimisation under flexibility constraints

The core of the model is maximisation of producer and consumer surplus subject to regional market balance and regional resource and crop rotation as well as animal feeding requirement constraints. Optimisation provides an annual supply and demand pattern using the outcome of the previous year as an initial value. The decision variables are number of animals, hectares of crops, feed use of animals, consumption, processing of sugar and milk products, transportation of products between regions, as well as imports and exports. Subsidies paid for farmers are exogenous parameters which are accounted as surpluses of the sector. Costs for taxpayers are not considered.

Different kinds of production lags in the different lines of production are taken into account by imposing constraints on the production variables in relation to the preceding year. Hence, production may change only within certain upper and lower bounds each year. These constraints imply that each optimum outcome may not correspond to an economic equilibrium, but a short-term reaction towards an equilibrium at the prevailing prices and subsidies. The changes are restricted in the short-term, but long-term changes may be considerable if the factors which are causing the change prevail long enough.

The development paths obtained from the dynamic model are, in some extent, dependent on the given limits for change. The absolute magnitude of the annual changes of the decision variables varies when using different limits for change, but the direction of the changes remains the same. There are many interdependencies between the decision variables in the model, however, and the flexibility constraints are most often not binding. Nevertheless, the constraints are important for ensuring the realism of the model. There are technical and biological restrictions which prevent large short-term changes in production. One can also use time series of agricultural production to justify the bounds for the decision variables.

The flexibility constraints may, in principle, represent not only technical and biological restrictions, but also cautious sub-optimisation and risk averse behaviour of farmers. Risk averting farmers are reluctant to drastic short-term changes or specialisation in production. Cautious sub-optimisation uses a one-period optimisation as the basis of choice without considering long-run trajectories based on explicit representation of the dynamic feedback of the markets (the concept of cautious sub-optimisation is also used by Day 1978, for example). Farmers do not make forecasts of future prices and subsidies and do not make any strategic long-term choices in the model. Rather, farmers respond to exogenous changes with more or less caution. This is quite reasonable assumption in the case of Finnish agriculture since future agricultural policy determined at the EU level and at the national level is highly unpredictable. Some individual farmers may have some long-term strategies. At the aggregate level, however, it is hard to justify strategic behaviour in terms of representative farms. The agricultural sector as whole or some large groups of farmers do not make joint strategic decisions.

7.3.2 Feeding constraints and fertilisation

Use of each feed stuff for each animal is a decision variable, which means that animals may be fed using different feed stuff combinations. The use of each feed stuff, however, is allowed to change only 5-10% annually due to biological reasons and fixed production factors. There are non-linear constraints relative to feed use. The required energy, protein and roughage needs of animals must be satisfied. Changes in feeding affect the milk yield of dairy cows. A concave quadratic function is used to determine the increase in milk yield as more grain is used in feeding. The parameters were estimated using experimental data from feed trials.

The use of fertilisers and the resulting crop yield is determined each year outside the optimisation model. This means that optimal farm level fertilisation corresponding a representative farm in each region is calculated using exogenous fertiliser prices and expected crop prices as well as crop yield functions. This means that farmers do not yet know the actual crop prices when making their fertilisation decisions. The actual prices are known only after the crop has been harvested and sold and it is assumed that farmers do not have rational expectations concerning the actual prices. Instead, the intervention prices or last year's prices are used in the model when calculating fertiliser use and crop yields. Furthermore, the expected prices may include, not only market prices, but also some price subsidies paid per kilo of production quantity. These quantity based price subsidies are paid until 1999 and thereafter in northern parts of Finland. Yield functions, which determine annual fertilisation and crop yield levels, were obtained by adjusting empirically estimated yield functions to the average fertilisation and yield levels.

7.3.3 Imports

All foreign trade flows are assumed to and from EU. It is assumed that Finland cannot influence the EU price level. For the part of imports, the domestic and the corresponding imported products are defined as imperfect substitutes. The demand functions of the domestic and imported products influence each other through elasticity of substitution.

The idea and the basic model of the imperfect substitution is as follows. Let Q_1 be the demand of domestic product and Q_2 the demand of the corresponding imported product in equations (1) and (2). P_1 and P_2 are the prices of domestic and imported products, respectively. Parameters A_1, A_2, B_1, B_2 and K are all positive and $(B_1B_2 - K^2) > 0$, when domestic and imported products are imperfect substitutes.

$$Q_1 = A_1 - B_1P_1 + KP_2 \tag{1}$$

$$Q_2 = A_2 + KP_1 - B_2P_2 \tag{2}$$

The inverse demand functions are (3) and (4).

$$P_1 = a_1 - b_1Q_1 - kQ_2 \tag{3}$$

$$P_2 = a_2 - kQ_1 - b_2Q_2 \tag{4}$$

The parameters of the inverse demand functions can be expressed as (5).

$$a_1 = \frac{A_1 B_2 + KA_2}{B_1 B_2 - K^2};\ a_2 = \frac{A_2 B_1 + KA_1}{B_1 B_2 - K^2};\ b_1 = \frac{B_2}{B_1 B_2 - K^2};\ b_2 = \frac{B_1}{B_1 B_2 - K^2};\ k = \frac{K}{B_1 B_2 - K^2} \qquad (5)$$

A demand system (3) and (4) is obtained when maximising consumer's utility function, which is concave and differentiable,

$$U(Q_1, Q_2) = a_1 Q_1 + a_2 Q_2 - \tfrac{1}{2}(b_1 Q_1^2 + b_2 Q_2^2 + 2kQ_1 Q_2) \qquad (6)$$

relative to budget constraint (income = $P_1Q_1 + P_2Q_2$). Differentiating (6) in respect to Q_1 and Q_2, inverse demand functions (3) and (4) are obtained. All parameters in equations (1-4) are positive and the utility function (6) is strictly concave.

In systems given by (1) and (2) and by (3) and (4) there are two equations and five unknowns in each, so additional conditions have to be defined in order to find the unknowns. Two more equations are obtained, when the total price elasticity of the product (7) as well as the substitution elasticity between domestic and foreign product (10) are defined. The total price elasticity is given by

$$\varepsilon = \frac{E_1}{E}(\varepsilon_{11} + \varepsilon_{12}) + \frac{E_2}{E}(\varepsilon_{21} + \varepsilon_{22}) \qquad (7)$$

$$\varepsilon_{ij} = \frac{dQ_i}{dP_j}\frac{P_j}{Q_i} \quad \text{i= 1,2: j=1,2} \qquad (8)$$

where εij is the price elasticity of demand of product *i* subject to the price of product *j*.

E is the total amount of money consumed for each product. $E_1=P_1Q_1$ is the value of domestic products and $E_2=P_2Q_2$ is the value of corresponding imported products.

$$E = E_1 + E_2 = P_1 Q_1 + P_2 Q_2 \qquad (9)$$

Substitution elasticity between domestic and imported product is defined as

$$\sigma = -\frac{d\log(\frac{Q_1}{Q_2})}{d\log(\frac{P_1}{P_2})} = \frac{(\frac{P_1}{P_2})\, d(\frac{Q_1}{Q_2})}{(\frac{Q_1}{Q_2})\, d(\frac{P_1}{P_2})} \qquad (10)$$

Given initial values for consumption, prices as well as the total price elasticity and the substitution elasticity, one can calculate the parameters of the demand system (3) and (4). Homothetic utility functions, however, need to be assumed in order to find algebraic expressions for the parameter values. A more detailed description of the demand function derivation, which follows the main lines of derivation presented by Dixit (1988) and Sheldon (1992), is presented by Lehtonen (1998, 1999).

A substitution elasticity approaching infinity means that domestic and corresponding imported products are perfect substitutes. In that case, products are identical, and any difference in price, however small, between the products is a sufficient incentive for consumers to shift totally to the cheaper product. In reality, however, domestic and corresponding imported products are most often imperfect substitutes. If the substitution elasticity is 1, parameter k in (3) and (4) is zero and domestic and imported products are then totally different products. If substitution elasticity were smaller than 1, the k-parameter is negative, which means that utility function would be no longer concave. Thus, the substitution elasticity must be greater than 1. The greater the substitution elasticity, the more similar are the products.

Values for the substitution elasticities are obtained either from market data or as guess values from experts. Substitution elasticity for beef, for example, is given value 2 in the model. Consumers are suspicious about the quality of imported beef and they are rather reluctant to change to imported beef. Some cereals and sugar, however, are mostly intermediate products used by food industry, and domestic and imported products can be regarded as homogenous. The substitution elasticity of sugar and some cereals are set to 15. The substitution elasticities of dairy products are in the range of 4 to 10 in the model. Domestic and imported cheese, for example, are qualitatively different, whereas butter and milk powder are considered more homogenous by consumers. The model results are not sensitive for minor changes in substitution elasticities.

7.3.4 Exports

The export products are still homogeneous with the domestic products. Using fixed EU price level it is possible that the exports of some products increase too rapidly without specific export costs. In reality, exports cannot in the short term grow too rapidly without considerable additional costs. For this reason, export costs have been modelled as linearly increasing with respect to the export quantities of the preceding year. The export costs remain constant if export quantities do not change from the preceding year. If exports increase from last year, export costs increase as well. On the other hand, the export costs decrease if the export quantities decrease. The change in the export costs is assumed to result from marketing costs, transportation arrangements, and other similar costs. These costs are less than 10% of the price of the product.

7.3.5 Increasing the efficiency of the production

Average farm size and investments in new production facilities are going up in Finland (Lehtonen et al., 1999). It is expected that the use of labour and capital is becoming more efficient. In the model target levels are set for labour and capital inputs by 2005, 2008 or 2010. The target levels are set as ratios in relation to the known use of inputs in 1995. The target levels may be set on the basis of earlier development, or they can be used as scenario parameters.

The dependency between the use of inputs and farm size can be approximated by equation (11).

$$\log C = \alpha - \beta \log KK \tag{11}$$

C is the production cost per unit, *KK* is the average size of the farm, and α and β are positive parameters. The parameters of equation (1) were estimated in Lehtonen et al. (1999) using cost differentials of farm models which are based on book keeping data (Ala-Mantila, 1998). If linear farm size growth in time is assumed then *KK* can be replaced by time, i.e. the parameters α and β are not estimated, but function (11) is calibrated to run from the initial value to the target value as a function of time. In this case the increase in production efficiency may not be linked only to farm size growth, but also to some other measures to rationalise production.

7.3.6 Fixed costs

There are no endogenous investment activities in the model. A certain fixed depreciation cost is assigned to the production activities per hectare or per animal. This means that expanding production implies increasing total depreciation while decreasing production means decreasing depreciation.

Fixed costs are sunk in the short-term, but in the long term they are variable costs. Because of debts, some farmers are obliged to carry on production even with low income after variable costs. Some specific schedules have been set for fixed costs of becoming variable costs in the model. This means that in the early years of the simulation some part of the fixed costs are sunk. The share of sunk cost decrease gradually to zero and then all costs are taken into account in the optimisation. The schedule is different in different lines of production but all fixed costs are considered in the optimisation at 2006 (Figure 7A.2 in Appendix 7A). Without sunk costs it is impossible to explain the production volumes during the recent years. Thus, the exogenously given sunk costs represent long term investment behaviour. This rather rough manner of modelling fixed production factors will be modelled in more detail in the future versions of the model.

7.4 Scenarios

An analysis made using the model is based on comparisons between the results of the so-called base scenario (with no policy changes) and alternative policy change scenarios. One compares the development path of the basic scenario with the development path of some alternative scenario. This kind of analysis is not based on comparative statistics, but on a kind of 'comparative dynamics'. The series of short-term disequilibrium representing the adaptation process of agriculture may or may not converge to a stable equilibrium.

Base scenario means that no significant policy reform will occur at year 2000 or after. The CAP is assumed to be unaffected from 1999 till 2010. Also EU price level of agricultural products are assumed to stay at 1999 level. However, some assumptions concerning national subsidies have to be made. In this study, the national subsidies are assumed 10% (on aggregate) lower than national subsidies at 1999. This assumption was seen reasonable and it is also used in some other unpublished policy analyses in Finland.

Agenda 2000 scenario follows the CAP reform agreement agreed by the EU ministers of agriculture in March 1999. Some minor refinements, however, have been made in grass silage subsidy to be paid in Finland (grass silage subsidy replaces silage maize subsidy since maize cannot be grown on the Finnish latitudes). Another exceptional subsidy to be paid only in Finland is a subsidy for grain drying. This special kind of subsidy will be paid per ton basis using CAP reference yields. All the Agenda 2000 subsidies, prices and production quotas are assumed to stay constant until 2010. This assumption is necessary since CAP after 2006 is unknown and there is few well grounded arguments in order to construct any detailed scenarios concerning CAP after 2006.

In addition to the policy parameters describing price and subsidy levels as well as production quotas there are some parameters in the model that describe development in productivity and production efficiency. Those parameters are kept constant when running a base scenario and a corresponding Agenda 2000 scenario.

One can define productivity and efficiency scenarios on the basis of different parameters representing productivity and efficiency growth. Comparing the results of different productivity and efficiency scenarios one may evaluate the direction and magnitude of policy effects on agricultural production and income. One may evaluate what is the likely level of agricultural production and income in different policy scenarios assuming a certain development scenario, or one may evaluate the needed development in order to reach a certain production or income level at different policy options. Using the model it is easier to understand the interplay and the dynamics of policy changes and agricultural development.

The results and thus the impacts of Agenda 2000 are conditional on the productivity and production efficiency parameters. Using different productivity and production efficiency development parameters for different pairs of base and policy scenarios, respectively, one can analyse the sensitivity of the production level and the policy effects on the different development parameters.

No such sensitivity analysis, however, is presented here but the effects of Agenda 2000 are evaluated using a fixed values of productivity and efficiency development parameters. The chosen parameter values represent relatively optimistic and rapid increase in production efficiency, which, in turn, requires a considerable growth in average farm size. The average size of a grain producing farm is assumed to double from 1999 till 2008 when the average farm size should reach 50 ha. The average size of dairy farms are assumed to increase from 15 cows per farm at 1999 to 21 cows until 2008. The average size of pork producing farm is assumed to increase from 150 fattening pigs to 500 pigs until 2008. Also the average size of poultry farms are assumed to increase more than 300% until 2008.

The milk yield of dairy cow is assumed increase linearly 100-120 kg per year (depending on region). At the same time it is assumed that the feeding requirements per dairy cow, however, will change only little. Thus, the total efficiency of dairy cows will improve as a result of increasing milk yields. Furthermore, if there are any changes in feeding such that more grain based feed stuffs are used in milk production the increase in milk yield may be slightly higher than the given linear increment. Thus, one should note that the increase in milk yields are not the same in base and Agenda 2000 scenarios since milk and grain prices are different and they affect the milk yields through the milk yield function.

The crop yields are assumed to increase only slightly during the simulation period. The annual linear increase in crop yields will be only 0.5% of the trend values of yields in 1998. This means that yield per hectare of grains, for example, increase 20-40 kg per hectare per year (depending on region). There are crop yield functions in the model, however, which may change the given crop yield development. In base scenario the fertiliser and crop prices stay constant and thus the crop yields are only affected by the exogenous linear increment. In the case of Agenda 2000 scenario the crop yields are further affected by changing crop prices.

The piglets per sow and eggs per laying hen will increase linearly as well. This represents the increase in a genetic potential of sows and laying hens as well as improvements in production practices. The piglets per sow is assumed to increase by 0.2415 piglets per year and the egg yield per a laying hen increases by 0.162 kg per year.

There are still some assumptions to be made which are relevant in medium and long term analysis. In both policy scenarios the need for investments increases during 1999-2006 since many production facilities built in the 1980s are wearing off. In the model this means that all fixed costs become variable and are assigned fully per animal from 2006 to 2010 when there are no sunk costs any more (Figure 7A.2).

Inflation of 1.5% is applied on the prices of production inputs. The input prices are fixed in the model, i.e. agriculture is assumed to be a price taker of inputs. No inflation is applied to output prices which are endogenous in the model, but heavily dependent on EU level prices.

7.5 Results

7.5.1 Dairy production

Let us look at the effects of CAP reform on Finnish dairy production which is the largest agricultural production line in Finland and constitutes nearly 50% of the Finnish agriculture. In CAP reform, milk prices will decrease 15% during 2005-2007 in three steps. A compensatory payment per milk quota ton increases in three steps up to 17.24 ecu/ton during 2005-2007. The average annual milk yield per dairy cow was approximately 7 tons in 1998 in Finland. A simple calculation shows that the compensatory payment is far below the income loss due to the price reduction. It also turns out that the grain drying subsidies (which will be paid in Finland because of the very difficult natural conditions) and the decrease in feeding costs due to decreasing grain prices (-15% during 200-2001) in the CAP reform will not be enough to maintain profitability. Thus, using a static reasoning one could argue that CAP reform will result to significantly lower milk production volumes than those in the base scenario. The dynamic disequilibrium model, however, provides a slightly different answer.

The results of CAP reform are compared with the base scenario solution in Figure 7A.3. In the base scenario prices and subsidies are assumed to remain at 1999 level up to 2011. According to the results, CAP reform results to higher milk production during 2000-2005 than the base scenario. This is due to decreasing grain prices and a slight increase in production quotas. Milk production remains close to quota until 2004 in the CAP reform scenario while production gradually falls in the base scenario. In the base scenario productivity growth and a relatively fast increase in production efficiency, which is the same as in the CAP reform scenario, is not enough to maintain production volumes close to the quota.

In the base scenario, productivity growth and increase in production efficiency is enough to compensate the inflation and production volumes become rather stable after 2006 when all fixed costs are taken into account in the optimisation. Thus, the production volume of 2.0-2.1 billion kilos seems to be close to equilibrium production volume in the base scenario at the specified inflation and productivity growth rates.

In the CAP reform scenario, the production starts declining by 3-5% annually (the number of dairy cows decrease 4-6% per year) at the year 2005 when milk prices start to fall due to dairy reform. The number of dairy cows was allowed to increase only 3% and decrease 6% annually in the model. After 2006 the productivity growth and increase in production efficiency are not enough to compensate the decreasing milk price due to CAP reform. Consequently, the production volume decreases close to 2.0 billion kilos until 2010 which is slightly under the base scenario volume. The production declines sharply even at the year 2011. It might take some time for milk production to stabilise into long term equilibrium value which might be considerably less than the equilibrium value in the base scenario. This is well in accordance with the static reasoning. What is important, however, is to realise that CAP reform will not result to significantly lower milk production volumes in the next ten years. If the productivity and production efficiency increase fast enough, decreasing grain prices give an extra boost for milk production which may even slightly increase before 2005.

7.5.2 Meat production

Beef production will decrease considerably in both base and Agenda 2000 scenarios because of unprofitable specialised beef production as well as decreasing number of dairy cows. Under the milk quota system which is to be maintained in both policy scenarios the average milk yield per dairy cow will result to a decreasing number of dairy cows and decreasing beef production if specialised beef production is unprofitable. This is the case in both scenarios: the number of suckler cows decreases at the given maximum rate i.e. the number of suckler cows reaches almost always the given lower bound. No realistic efficiency or productivity development rates were found in order to make specialised beef production competitive with imports. There are considerable difficulties in beef production in Finland because of a short grazing period and a long housing period. Furthermore, the size of specialised beef farms is rather low. No considerable progress can be expected in this respect and some additional support measures are required if beef production is to be reach the national self sufficiency level. The specialised beef production produces less than 10% of the current beef production in Finland.

Thus, the beef production is largely driven by the milk sector and the number of dairy cows. In agenda 2000 scenario the level of beef production stays at a higher level than in the base scenario until 2006 (Figure 7A.4). After that the beef production volumes are roughly equal in both scenarios and roughly 25% of beef will be imported until 2010.

In the case of pork production Agenda 2000 has is no significant effect on pork production volumes in long term (Figure 7A.5). The total volume, however, is likely to decrease faster in Agenda 2000 scenario because of lower EU level prices which are due to lower grain prices and lower feed costs. In agenda 2000 it is assumed that the price level in EU will decrease 12% because of decreasing grain prices. The total pork production volume decreases in both scenarios to a level of 165 million kg because of fixed costs and rather low EU level prices which are assumed constant 1999-2010 in base scenario. The pork production volumes have been increasing in Finland during the period 1995-1998 because of investment aids needed in order to reach a higher efficiency level and farm size. At the same time, many small pork producers have given up production but some pig farms will stay in business until their production equipment are usable. In later years the investments have to be paid back and the remaining small pig farms have to exit production because of the need of investments. This means that full production costs are taken into account in the model after 2006 (Figure 7A.2) and the pork production volumes will stabilise at the level which is roughly equal to domestic consumption. It is not realistic to expect Finnish pork production to be competitive at the exports markets but because of subsidies it is possible to retain a production level corresponding to domestic consumption. However, heavy investments are still necessary in order to reach the required efficiency level.

Poultry production is to be increased in both scenarios because of increasing domestic consumption. The farms producing poultry meat are already quite large and industrialised but still larger units are required in order to reach the required efficiency level. Otherwise the increasing consumption will be covered by imports. As in the case of pork, it was assumed that poultry prices will be decreased by 12% in Agenda 2000 because of decreasing grain prices. This results to slightly lower production volumes than in the base scenario (Figure 7A.6).

There is still more egg production than consumption in Finland. The level of egg production, however, will soon adjust to close to the domestic consumption level, according to the model results. All sunk cost are fully taken into account in the decision making in the model until 2006 and the number of egg producers will decrease considerably because of decreasing exports and growing farm size. However, even a relatively rapid improvements in efficiency will not keep up the production volumes. On the other hand, there will be no or little egg imports. Agenda 2000 have no significant effect on this development, even if egg prices are assumed to decrease 12% in EU because of decreasing grain prices. Due to decreasing production and investments there will be less than 300 egg farms in Finland in 2008.

7.5.3 Crop production

Crop production is heavily dependent on subsidies in Finland because the market prices hardly cover the variable costs of production. This difficulty, which may result to perverse (cost minimising) production practices at farm level, is further magnified by the Agenda 2000 which will decrease grain prices by 15% during 2000-2001. The average yields of grains are 2-4 tons per hectare in Finland (depending on the region). This, together with the need to dry the grain always after the harvest makes Finland rather unfavourable for crop production. The Finnish specific grain drying subsidies agreed in Agenda 2000 will improve this situation slightly and provide some more coverage for the variable costs, even if the grain drying subsidy is paid per hectare basis according to the CAP reference yields.

They are not only the natural conditions which make it problematic for the Finnish farmers to continue crop production. The average size of crop producing Finnish farms is approximately 25 hectares and this is too low to be able to utilise economies of scale. In the scenarios a significant efficiency gain is assumed. According to bookkeeping data the relationship between the production costs and farm size is such that a considerable increase in farm size is needed in order to decrease the production costs. Thus, if production efficiency is expected to increase 12% the average farm size should increase up to 50 ha up to 2008.

According to the model results, grain production and areas under crop cultivation will decrease significantly until 2010 (Figure 7A.7, 7A.8). Exports of grains will decrease close to zero and also silage and green fodder areas will decrease 45% because of decreasing dairy cow and suckler cow numbers as well as changes in animal feeding (Figure 7A.9). Subsidies for grain will make it more desirable to use more grain based feed stuffs in feeding of cattle animals despite of the fact that silage and green fodder give higher yields per hectare (in terms of fodder units). This change combined with decreasing grain areas will decrease the crop areas by 35% (25-50% depending on the region). A remarkable share of arable land will become idle especially in eastern and northern part of the country even if a rapid increase in farm size and production efficiency is assumed.

7.5.4 Agricultural income

In both scenario runs the total agricultural income will decrease 20% during 1999-2010 (Figure 7A.10). This is due to a decrease in the volume and profitability of production. This is likely to happen despite of the relatively rapid improvements in productivity and efficiency of agricultural production. However, this result is conditional on the level of the national subsidies which are assumed to be 10% lower than actual 1999 national subsidies and to stay at constant level after 1999.

Nevertheless, one can conclude that Agenda 2000 will not result to any significantly lower total agricultural income than the base scenario in the next ten years. What is remarkable, however, is that the agricultural income (as well as milk production) still decreases in the last years of the simulation while in the base scenario the production and income levels are stabilised. This means that long term impacts of Agenda 2000 will be somewhat negative in terms of milk production volumes and agricultural income.

7.6 Conclusions

To conclude, it is difficult to say what is exactly the effect of CAP reform on agricultural production, i.e. on the production volume at the equilibrium. The effects are conditional on many other changes affecting agriculture at the same time. The equilibrium itself is changing over time because of increasing productivity and production efficiency, and inflation, for example. Furthermore, the effect of CAP reform is different in different time points. By choosing different values of the productivity and efficiency parameters one can find different development paths of agricultural production and also different steady state equilibrium. Using the DREMFIA model one can analyse different possible future paths and find some range of production volumes and agricultural income levels which are likely to take place in reality. One may also find the sufficient level of productivity and production efficiency and the related farm size growth which maintains some desired production level.

Because of many exogenous variables the model is not intended to produce exact forecasts of the future. The model should be used in comparing between different development paths, not primarily in predicting the single path which will occur. The policy effects are dependent on the exogenous variables. Different exogenous variables produce different kinds of development paths. The magnitude of changes may change using different exogenous variables or flexibility constraints. Thus, some sensitivity analysis is needed before making final conclusions on the magnitude of policy effects.

One should also evaluate the robustness and realism of the results presented. The major assumption in the model is perfect competition and a high level of rationality. This means that farmers optimise their profit and make their annual production decisions in a rational way.

There are two kind of adjustment mechanisms in the model which prevent further decline of production and agricultural income. First, there are endogenous adaptation mechanisms concerning feeding of animals and fertilisation. They change as a result of changes in prices and subsidies and this affect also crop and milk yield levels through yield functions. Even if the annual changes in feeding are bounded using the flexibility constraints (use of each feed stuff may change 5-10% per year) the model may exaggerate the rational behaviour of farmers and the actual production and agricultural income levels may be lower.

The exogenous adaptation mechanisms include changes in productivity and production efficiency. The productivity rates used in the scenarios are somewhat realistic and they can be reasonably achieved. The efficiency development, however, requires a lot of further investments in order to utilise modern less labour intensive production technology and economies of scale. In the case of dairy cows the average size of dairy herds could grow up to 21 cows until 2008, but this cannot happen if many individual farms will not grow. Many small dairy farmers have exit the business and the average size of dairy farms cannot be grown anymore only by decreasing the number of small scale producers. Increasing the size of many dairy farms requires flexible trading systems of milk quotas as well as land availability in order to meet environmental regulations.

Increasing farm size is not, however, the only way to improve the efficiency of dairy sector. There are considerable differences in production costs of farms of the same size. Production costs and farm size do not correlate exactly and that is why many larger producers have decided to exit dairy production as well. Smaller milk producers may stay in business if they are able to operate more efficiently than larger firms. The most likely future development of prices and subsidies, however, will make it desirable for farmers to concentrate in increasing efficiency rather than increasing productivity. Thus, in the case of Agenda 2000 and decreasing milk prices the farms that are able to producing at a low cost (possibly with slightly lower milk yields per dairy cow than some other farms with higher cost level) and are able to further improve the production efficiency are able to continue production in the future. One can say, however, that it is often easier for larger farms to increase the production efficiency than for smaller farms.

In the case of pork and poultry sectors the correlation between farm size and production efficiency is more obvious. The assumed increase in efficiency requires a significant decrease in the number of farms and heavy investments for some remaining farms to achieve the higher efficiency level. Further investment aids are needed in these sectors in order to keep the level of production.

In this study FADN data has been used in estimating the relationship between farm size and production costs as well as differences in production costs between different regions. These cost differences together with the policy parameters drive the regional production allocation in the model. The exact level of the production costs is difficult to estimate, but FADN together with some other data (collected by farm advisory centres, for example) can be used in estimating the relative differences in production costs between the regions as well evaluating the possible reasons for the differences. Using micro level data and some a priori information concerning production decisions at the farm level provide valuable information in performing sector level policy analysis. The DREMFIA model and its data system will be further developed in order to use FADN and other farm level data more effectively.

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Appendix 7A

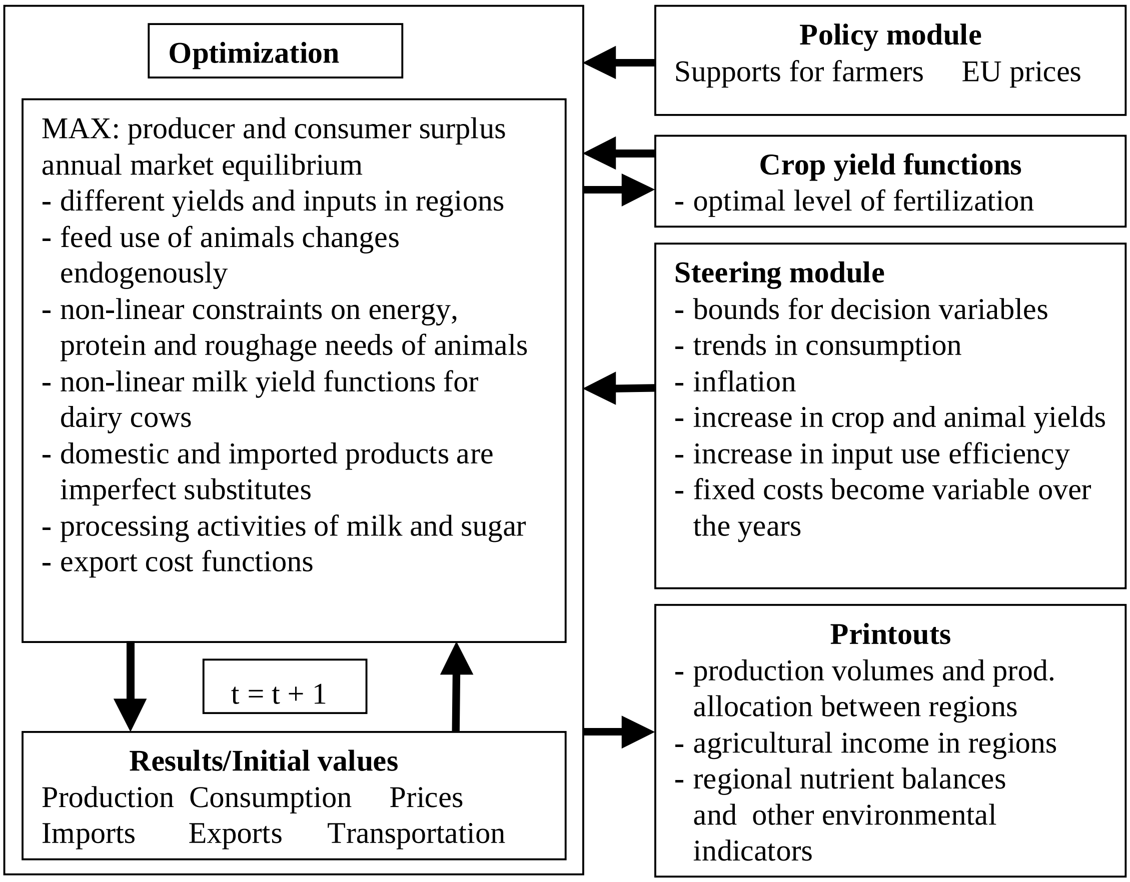

Figure 7A.1 Basic structure of the DREMFIA model

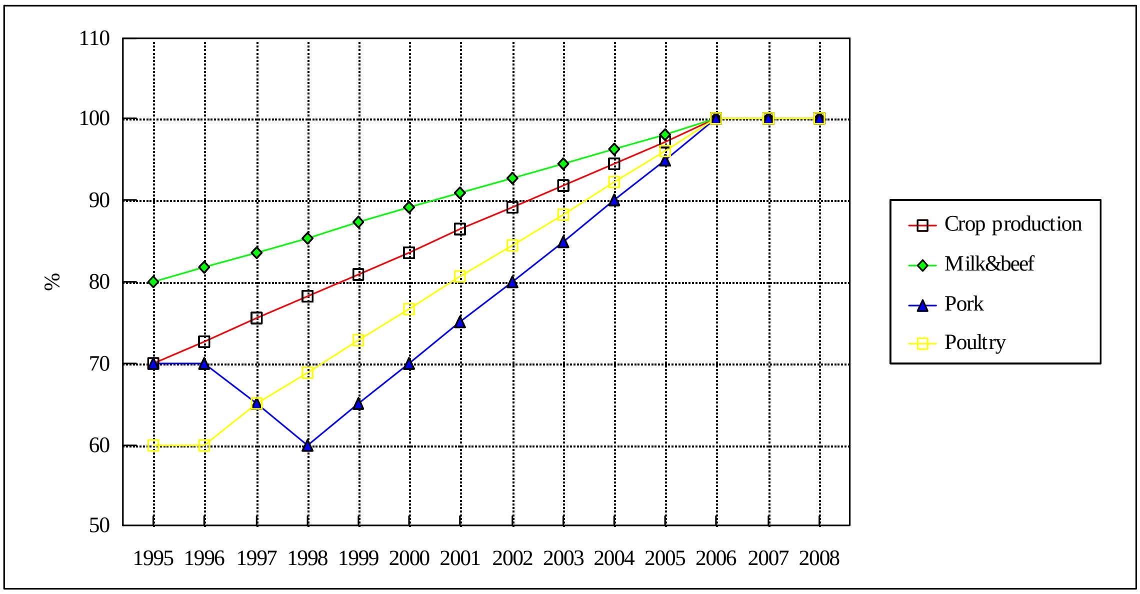

Figure 7A.2 Sunk costs (fixed costs) become fully variable until 2006

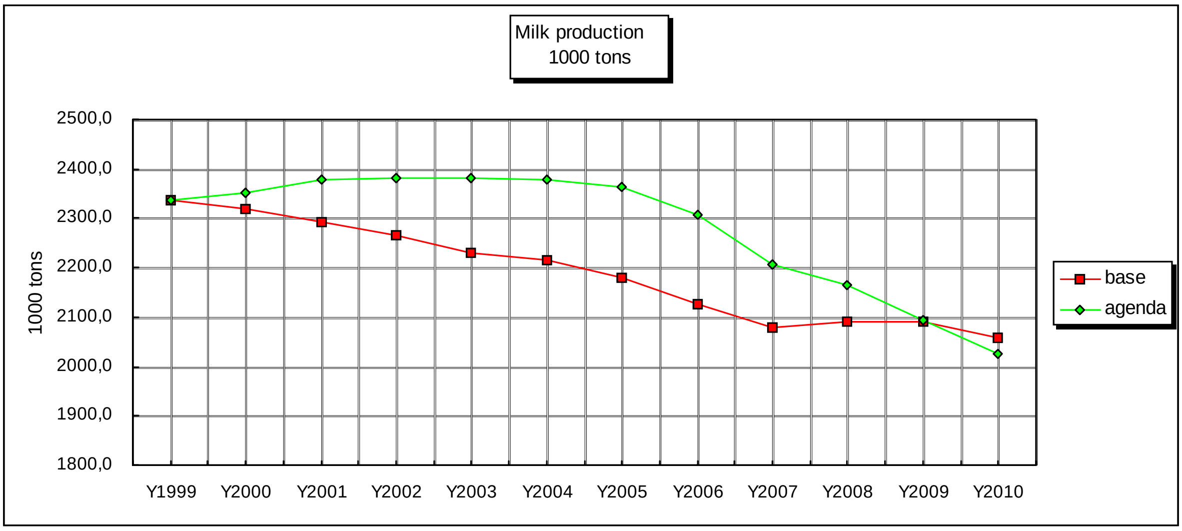

Figure 7A.3 Milk production

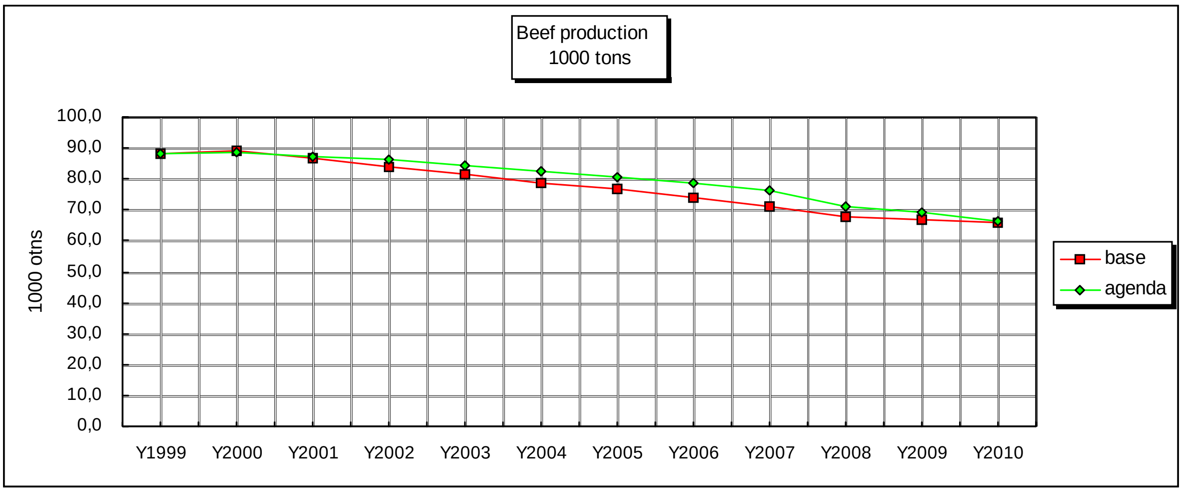

Figure 7A.4 Beef production

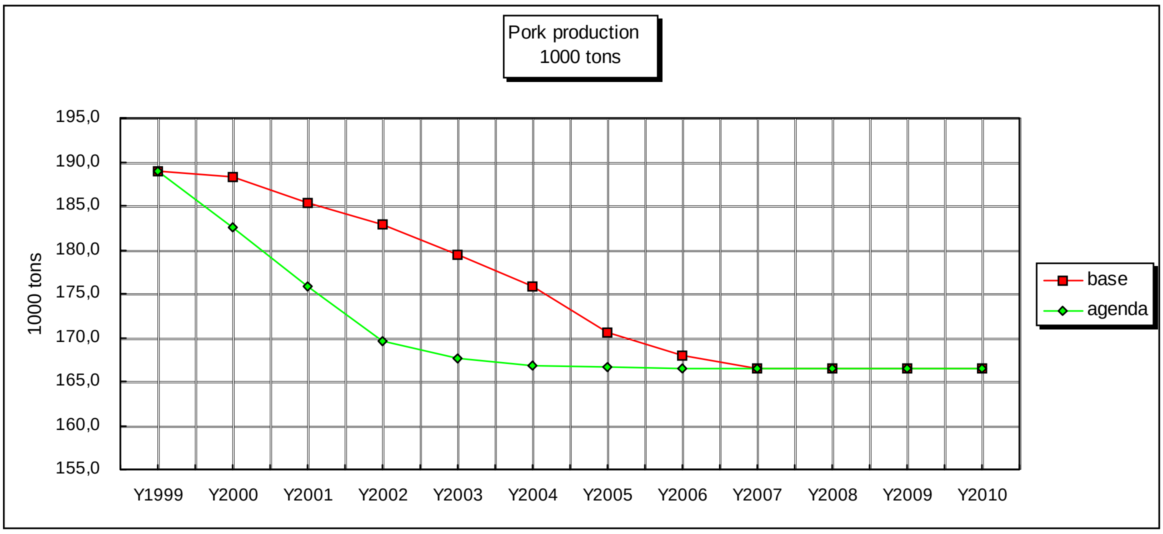

Figure 7A.5 Pork production

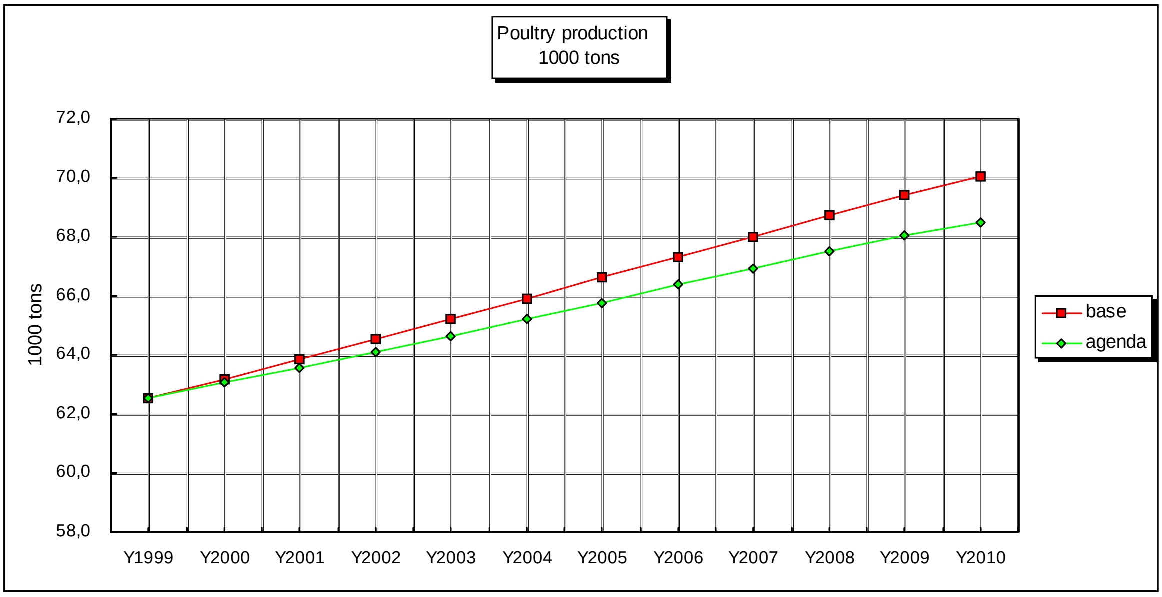

Figure 7A.6 Poultry production

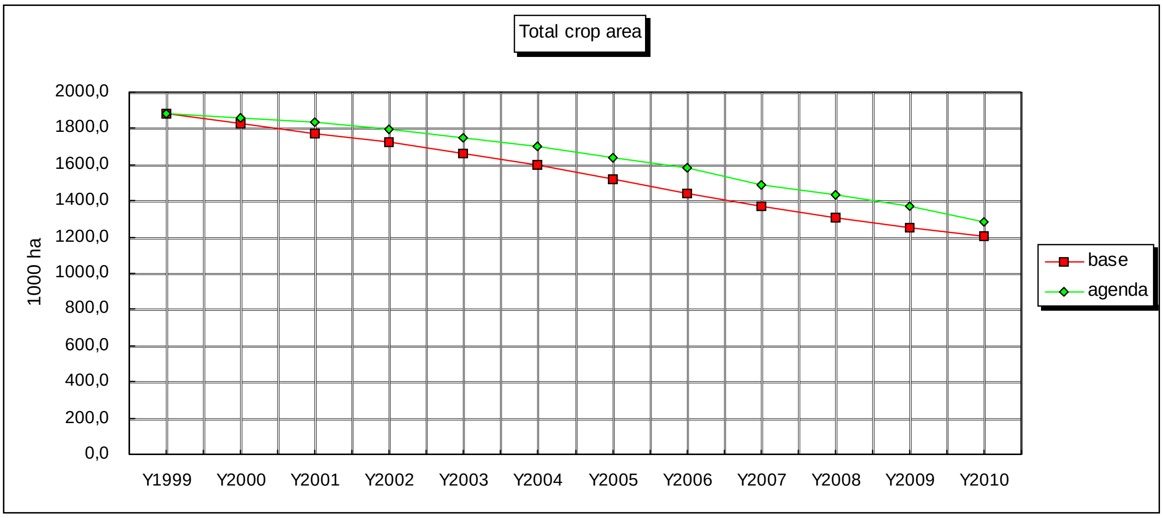

Figure A7.7 Total crop area

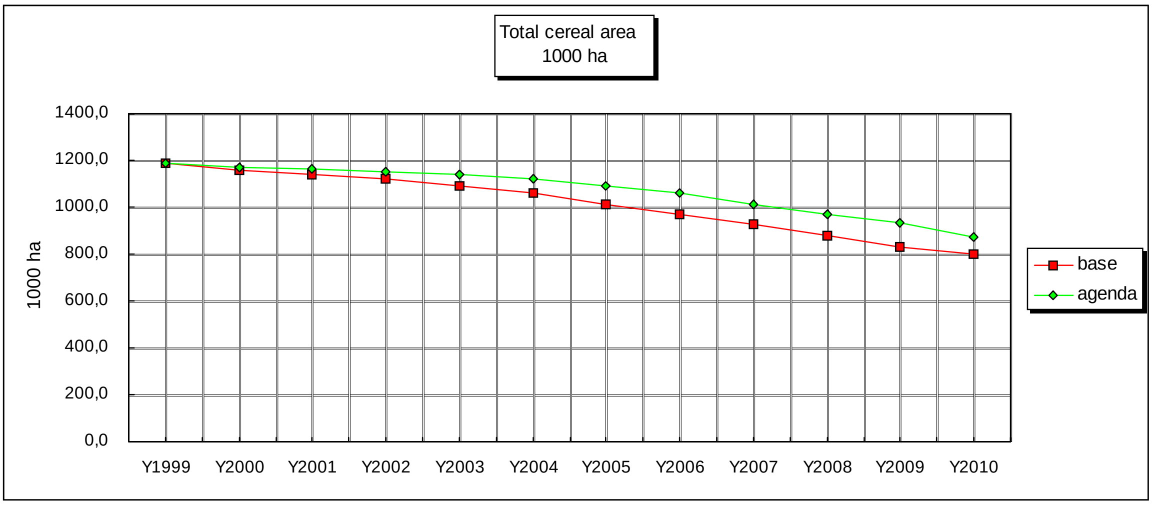

Figure 7A.8 Total cereal area

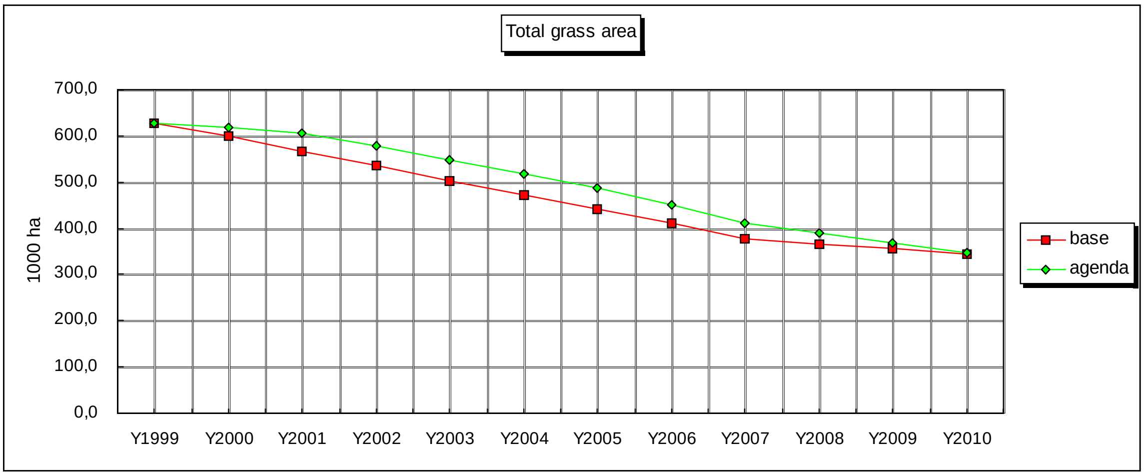

Figure 7A.9 Total grass area

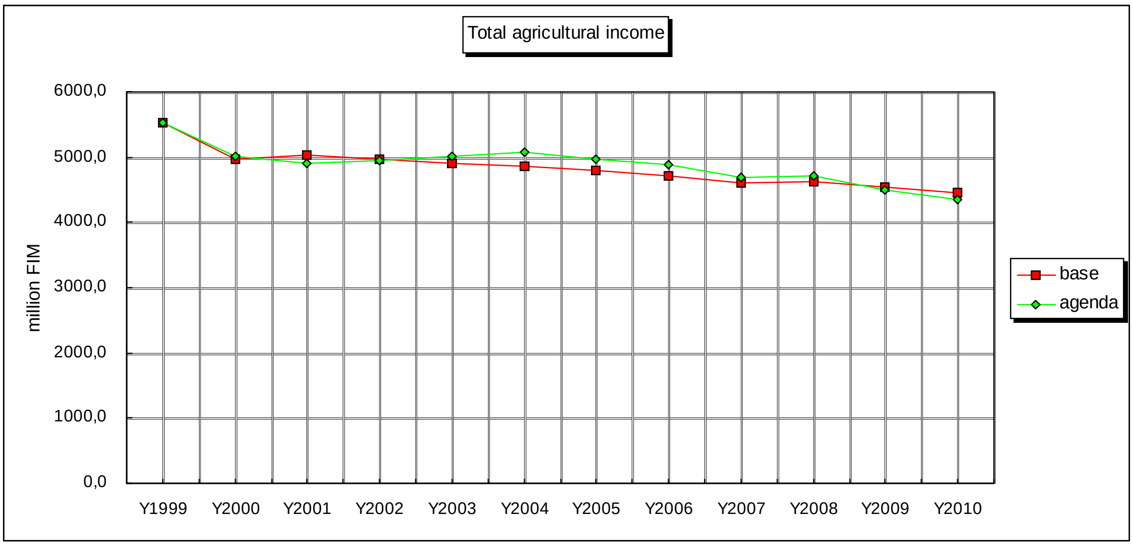

Figure 7A.10 Total agricultural income

8. The profitability of the agricultural sectors of the European Union

Carlos San Juan [1], *Esther Decimavilla Herrero* [2]

Key words: Profitability, European Union, Agriculture, Farms, Common Agricultural Policy, Credit, Total Factor Productivity, Farm Accounting Data Network, RICA

8.1 Introduction

Profitability is a concept that is defined as the relationship, at current prices, between the flow of payment of capital and capital stock available.

Profitability as does productivity, serves to show the relationship of results obtained and the methods used to obtain them. Nevertheless, the difference between one measure and another is that productivity refers to the results and technical measures (production and material resources), whereas profitability refers to financial results and resources. In this way, the most productive agricultural enterprises are not necessarily the most profitable due to the variations of relative prices of input and output.

The objective of this paper is to calculate the profitability of the different European agricultural sectors during the period of 1986-1994, comparing it to results obtained by calculating the Total Factor Productivity (TFP).

This study is based on microeconomic data compiled by FADN (Farm Accountancy Data Network) which collects representative samples of standardised accounting from farming enterprises of the European Union (EUR 12) (For details about data see the appendix on San Juan and Decimavilla, 1999).

In a previous paper we verify that the differences at the spatial level are statistically significant, using an unbalanced fixed effects model for farms profitability (San Juan et al., 1988).

8.2 Profitability indicators

The three indicators that we used to measure the return on capital of the different agricultural sectors of the European Union are as follows:

a. Gross Rate of Return:

$r_1 = GS_t / K_{t-1} \times 100$

where

[1] Carlos III University of Madrid.
[2] Valladolid University.

GS_t = Gross Operating Surplus at time -t-.
K_{t-1} = Capital at time -t-1-.

This first indicator measures the relationship, at current prices, of the flow of income to available capital at the start of the accounting period [1].

b. Net Rate of Return:

$r_2 = NS_t / K_{t-1} \times 100$

where

NS_t = Net Operating Surplus at time -t-.
K_{t-1} = Capital at time -t-1-.

Net rate of return measures the relationship, at current prices, of capital inflow minus amortisation and capital available at the start of the period.

The comparison of the gross rate of return and the net rate of return allows us to see the effect of fixed capital consumption on profitability.

c. Rate of Return on Equities:

$r_3 = FFI_t / OK_{t-1} \times 100$

where

FFI_t = Family Farm Income at time -t-.
OK_{t-1} = Own Capital at time -t-1-.

The rate of return on equities measures the relationship, at current prices, between net income and equity. This is a return after taxes and takes into account that part of the net operating surplus is designated to pay back borrowed capital.

The difference between this indicator and those previously mentioned is determined by the value of the amortisation and by the variations in debt ratios and costs of borrowing.

The variables necessary for these profitability indicators are obtained from the following accounting factors:

(1) GS = GFI – TLC

where

GS = Gross Operating Surplus.
GFI = Gross Farm Income
TLC = Total Labour Cost (including Labour Family Remuneration, supposing that labour family is paid at the same amount per hour worked as a salaried labour force).

(2) NS = GS - D

[1] This variable is gathered later because the data on capital funds refers to the 31 of December of each year, and as a result, the capital from 31 December of year t-1 is what is used during year t. We do not have information about maturity period for the investments during the year.

where

NS = Net Operating Surplus.
GS = Gross Operating Surplus.
D = Depreciation.

(3) FFI = NS – R&IP – IG&S

where

FFI = Family Farm Income (Return on Equities).
NS = Net Operating Surplus.
R&IP = Rent and Interest Paid.
IG&S = Investment Grants and Subsidies.

(4) K = OK + L

where

K = Total Capital.
OK = Own Capital.
L = Liabilities.

The statistical source, FADN, gathers the variables in current ECUs; nevertheless, and given the profitability comparison that we wish to carry out, we have converted the current values into constant price using the Standard Purchasing Power Index. To do this, we used the Index published by EUROSTAT.

8.3 Results and final comments

The different profitability indicators by country show the following results as averages during the period (detailed data to be found in Appendix 8A).

Table 8.1 Rate on return (average 1986-1994)

Country	r1	r2	r3
EUR12	5.09	1.16	-1.26
Belgium	17.94	12.78	13.93
Denmark	7.92	3.19	-20.28
France	12.73	4.41	-2.54
Germany	7.89	2.24	-0.70
Greece	9.16	6.35	5.33
Holland	10.46	5.87	3.84
Ireland	2.79	1.11	-0.05
Italy	-0.88	-3.27	-3.63
Luxembourg	11.32	5.50	5.00
Portugal	0.06	-3.03	-3.17
Spain	5.11	2.86	2.34
United Kingdom	7.34	3.82	1.55

As would be expected, the levels of profitability that were obtained are low, even negative. This is because when the gross operating surplus was calculated, we discounted the cost of labour; not only salaried, but also imputed to family. We considered that in order to analyse the profitability of farming enterprises it is necessary, as with any other type of enterprise, to take into account the total cost of labour.

Additionally, the gross rate of return is higher than the net rate and also higher than the rate of return on equity (see figures in Appendix 8A). This relationship is a consequence of the negative effects of the amortisation and the debt ratio on the rate of return on equities.

The ranking of countries from highest to lowest profitability, according to the type of indicator that we used are shown as follows in Table 8.2.

Table 8.2 Rate on return

r1	r2	r3
Belgium	Belgium	Belgium
France	Greece	Greece
Luxembourg	Holland	Luxembourg
Holland	Luxembourg	Holland
Greece	France	Spain
Denmark	United Kingdom	United Kingdom
Germany	Denmark	Ireland
United Kingdom	Spain	Germany
EUR12	Germany	**EUR12**
Spain	**EUR12**	France
Ireland	Ireland	Portugal
Portugal	Portugal	Italy
Italy	Italy	Denmark

With regard to the European average, the results obtained during this period show that:

- in the gross rate of return (r1), the countries situated below the average are Italy, Portugal and Ireland; similarly (although slightly above the average) is Spain; and the rest of the countries can be found above the average (Belgium, France, Luxembourg, Holland and even Greece were notably high).
- in the net rate of return (r2): Italy, Portugal and Ireland are again below the average. The rest are above; especially Belgium, Greece, Holland, Luxembourg and France.
- in the rate of return on equity (r3): Denmark, Italy, Portugal and France show negative returns and are below the European average. The countries with negative returns, but higher than the average, are Germany and Ireland. The rest of the countries showed a positive return and are above the average. The most notable were Belgium and Greece.

What should be pointed out in the comparison of the ranking of countries when going from the gross rate of return (r1) to net rate of return (r2) is that:

- Belgium is, with both indicators, the country with the most profitable agricultural sector, and well above the community average;
- Ireland, Portugal and Italy are, again using both indicators, the least profitable countries in the European Union;
- none of the other countries significantly change their ranking using either indicator; the slight changes are due to the weight of the amortisation over total capital. So, on the one hand, Spain, Greece and the United Kingdom somewhat improve their results in terms of net rate of return because the weight of amortisation within total capital is below the average (3'8%); to be exact, 2'4%, 3'2% y 3'2% respectively. On the other hand, in Denmark, Germany, France and Holland, the amortisation of total capital is 4'4%, 5'8%, 9'4%, 4'7% y 9'6, respectively, which causes their drop in ranking in terms of net rate of return with respect to gross rate of return.

The key question is whether the differences between net and gross rate of return are due to a lack of homogeneity in the accounting practices when calculating amortisation or there is a real difference in the capital structure of the farms.

If we accept the available information as homogeneous, we would have to conclude that amortisation is affecting the net rate of return of the farms more in some countries, like France, and to a lesser degree, Luxembourg and Germany (see Figure 8.1).

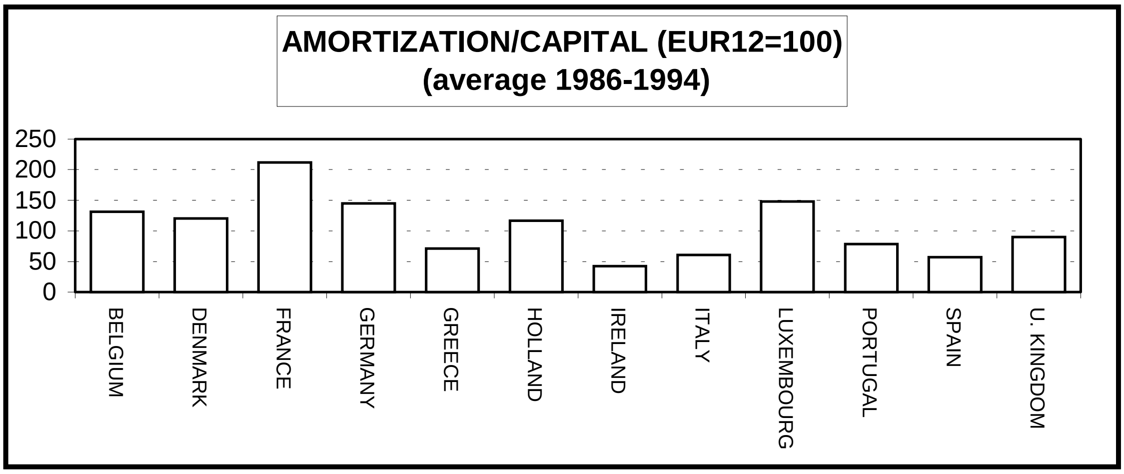

Figure 8.1

When comparing the ranking of countries and the effect of net rate of return (r2) to rate of return on equities (r3), the most notable aspects are that:

- Belgium, Greece and the United Kingdom maintain their positions at the top of the ranking.
- Holland, Germany, Portugal and Italy show no significant changes given that their rankings shift no more than one position.

- France and Denmark clearly lose positions to Spain and Ireland. This gain or loss of positions is no doubt due to the debt ratios of the farms (see Figure 8.2). Therefore, on average, equity represents 80% of total capital in farming enterprises in the European Union, while in Spain it represents 98% and in Ireland, 94%, both well above the average. On the contrary, in France it is 46% and in Denmark, 26% which are far below the average.

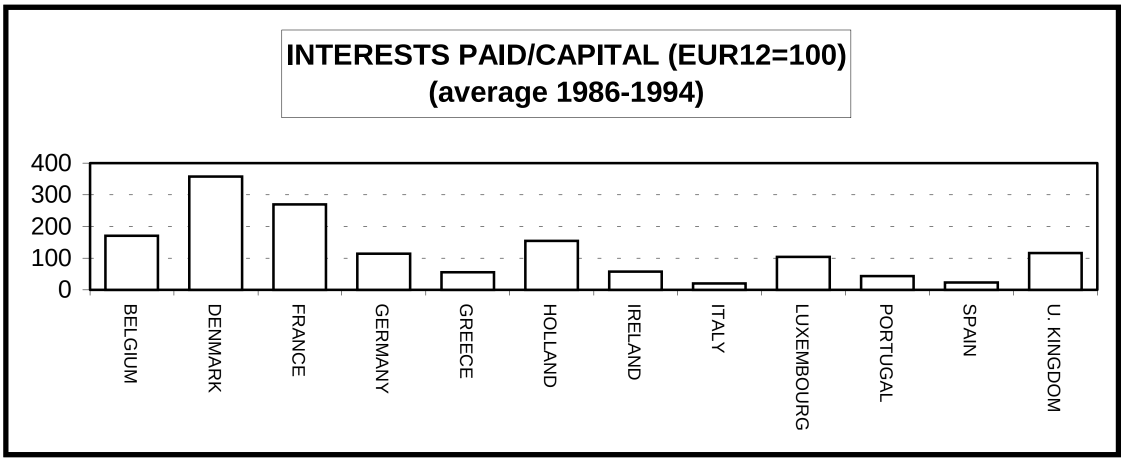

Figure 8.2

The preceding results can be seen more clearly in the following Figures, 8.3, 8.4 and 8.5.

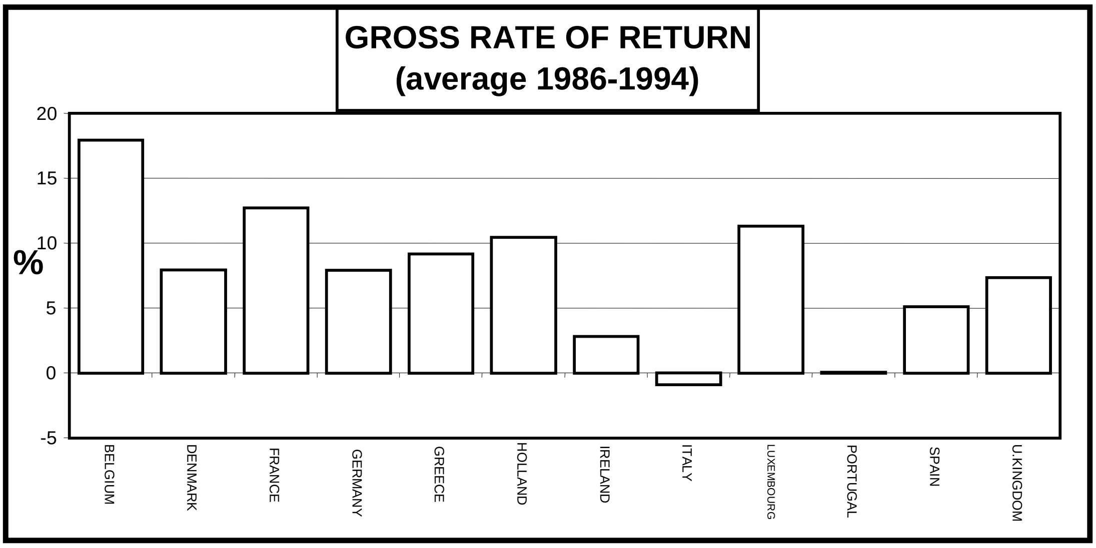

Figure 8.3

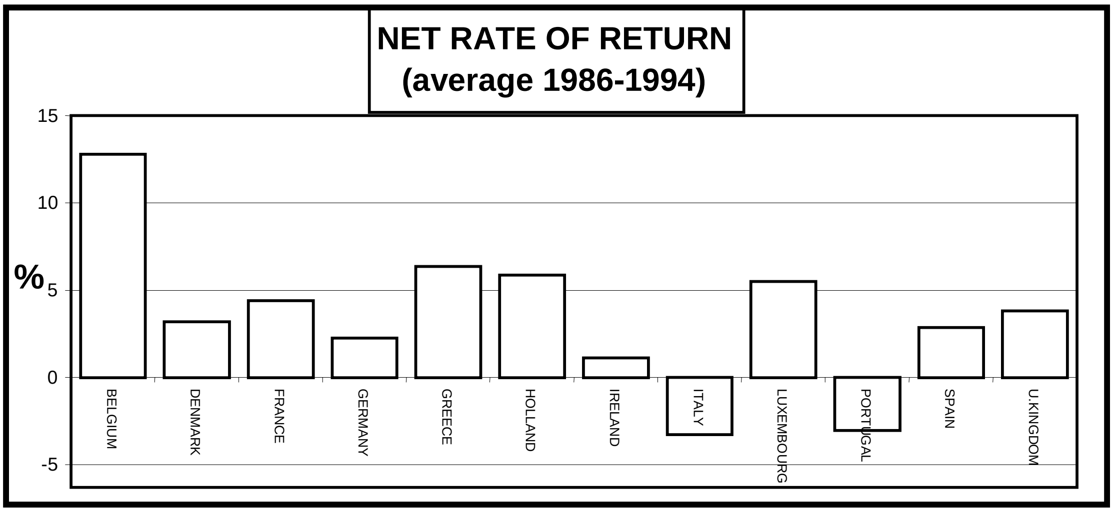

Figure 8.4

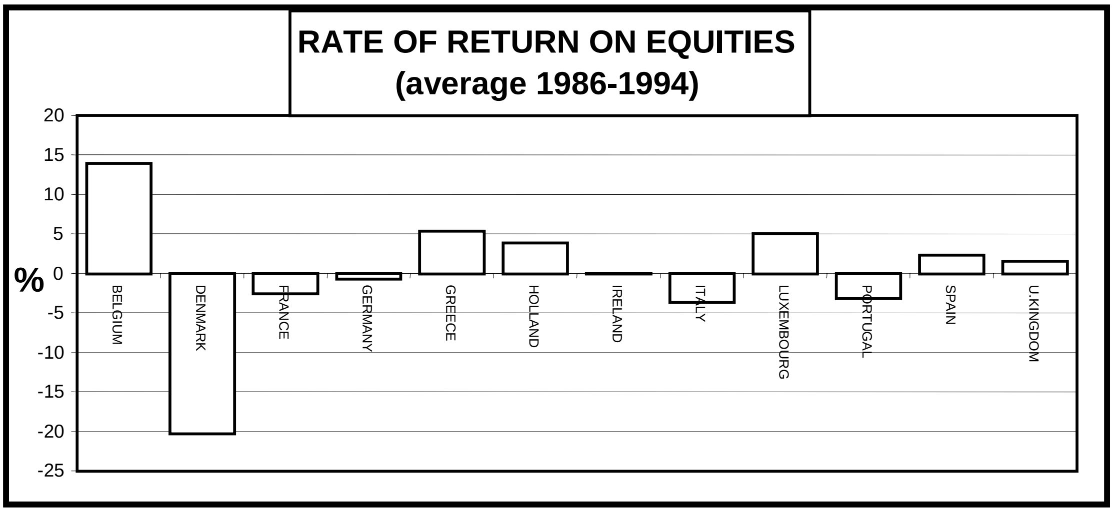

Figure 8.5

The question that should be raised regarding the previous comments is as follows: Are the profitability results in agreement with those of productivity? From the study done on Total Factor Productivity, using the Fisher Ideal Index, we know that the ranking of the twelve European Union countries that were analysed, from highest to lowest productivity, is: Belgium, Holland, France, Denmark, United Kingdom, Luxembourg, Germany, Spain, Italy, Ireland, Greece and Portugal. (For details about TFP calculation see San Juan and Decimavilla, 1999.)

When we compare this ranking with the one obtained for profitability (see Figure 8.6), we see that although, in general, the most productive agricultural sectors are also the most profitable, there are some exceptions that deserve to be studied in more detail.

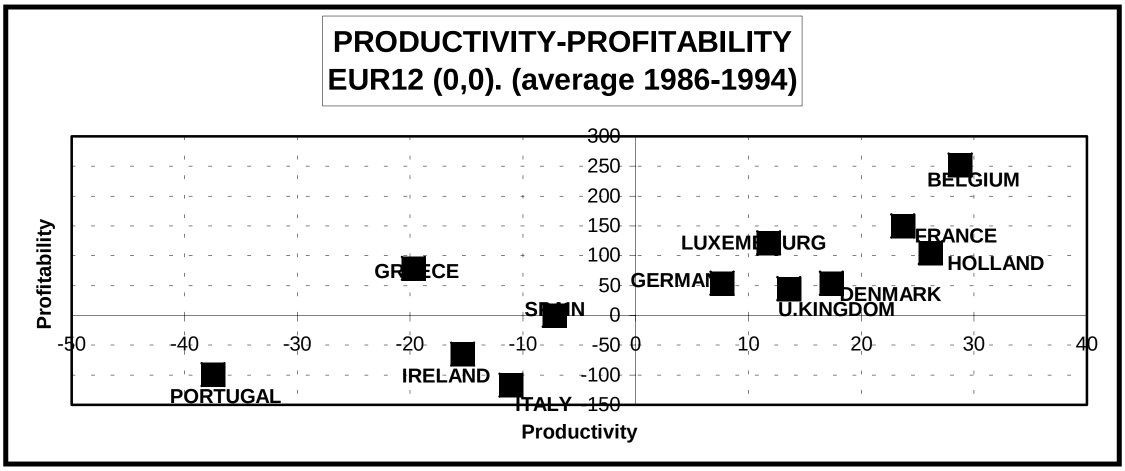

Figure 8.6

In the first place, the high ranking of Greece using any of the profitability indicators is in contrast to its reduced productivity. This situation can be explained if we take into account the fact that Greek agriculture is quite extensive, under-capitalised (see Figure 8.7) and uses a great deal of labour (especially family). This family labour is calculated, following this method, at the same hourly rate as salaried farm labour in Greece. Having salaries which are low compared to the European average results in operating returns which are surprisingly high in relation to its low productivity (see Figure 8.8).

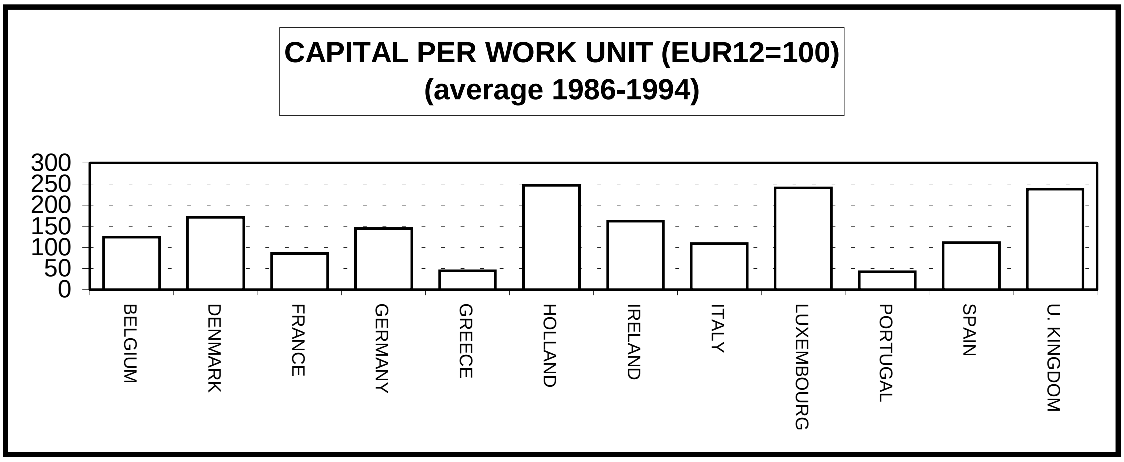

Figure 8.7

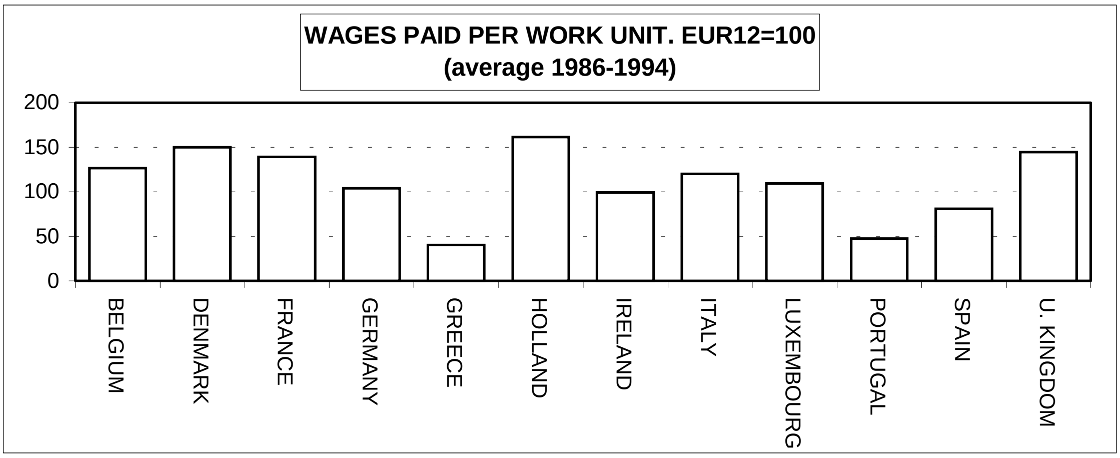

Figure 8.8

In the second place, what is notable is the low rate of return on equity in France and Denmark given their high productivity. These countries have borrowed more heavily than the others to capitalise their farms (Blogowski, 1984, 1985): and this high debt ratio affects the rate of return on equity; nevertheless, one can expect that if these investments were well planned, these farms will recover their positions in the medium to long term.

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Appendix 8A

Gross rate of return

Year	EUR12	Belg.	Denm.	France	Germ.	Greece	Holla.	Irela.	Italy	Luxem.	Port.	Spain	U.King.
1986	5.07	19.12	6.04	6.19	7.01	5.74	9.66	0.55	-2.15	11.64	4.60	6.78	7.16
1987	4.52	15.48	6.15	9.01	5.91	7.19	9.75	2.69	-1.71	11.61	3.47	5.47	6.80
1988	5.20	19.57	7.85	11.12	8.11	8.75	11.36	4.62	-1.72	12.38	1.39	3.95	6.56
1989	6.11	22.87	11.92	14.18	9.32	10.91	13.63	3.12	-1.22	15.17	2.93	3.38	7.48
1990	4.65	18.24	7.35	14.07	7.80	9.89	11.32	1.73	-0.94	11.97	0.02	2.12	6.85
1991	4.93	18.76	7.74	15.21	8.10	8.09	11.68	1.95	-0.16	12.71	0.61	1.71	6.82
1992	4.77	15.13	6.55	14.89	8.09	8.97	8.61	3.03	-0.83	9.59	-3.37	6.24	7.57
1993	5.19	15.76	7.89	13.45	8.14	10.33	8.28	3.52	0.15	8.63	-5.25	7.61	8.19
1994	5.41	16.49	9.80	16.42	8.56	12.57	9.85	3.87	0.63	8.18	-3.85	8.72	8.68

Source: Own elaboration.
Note: Gross Rate of Return=Gross Operating Surplus/Capital.

Net rate of return

Year	EUR12	Belg.	Denm.	France	Germ.	Greece	Holla.	Irela.	Italy	Luxem.	Port.	Spain	U.King.
1986	1.46	14.25	2.19	-0.11	1.54	3.22	5.41	-1.14	-4.36	5.67	2.50	4.84	3.27
1987	0.72	10.54	0.99	1.93	0.46	4.52	5.20	0.93	-4.09	5.33	0.83	3.45	3.18
1988	1.35	14.71	2.62	3.29	2.65	6.06	6.89	2.74	-4.21	5.97	-1.03	1.53	3.03
1989	2.17	17.99	6.61	5.99	3.77	8.14	9.16	1.15	-3.77	8.67	0.16	0.78	3.91
1990	0.69	13.15	2.66	5.74	2.06	7.06	6.80	0.15	-3.46	5.25	-2.95	-0.17	3.30
1991	0.92	13.60	3.04	6.69	2.33	5.34	7.03	0.36	-2.65	5.89	-2.42	-0.65	3.31
1992	0.62	9.70	1.80	5.41	2.27	6.03	3.84	1.37	-3.34	5.08	-7.00	4.12	4.13
1993	0.88	10.24	3.41	3.77	2.29	7.35	3.36	2.01	-2.45	4.04	-9.24	5.47	4.75
1994	1.64	10.87	5.40	6.99	2.78	9.47	5.11	2.38	-1.08	3.59	-8.09	6.36	5.46

Source: Own elaboration.
Note: Net Rate of Return=Net Operating Surplus/Capital.

Rate of return on equities

Year	EUR12	Belg.	Denm.	France	Germ.	Greece	Holla.	Irela.	Italy	Luxem.	Port.	Spain	U.King.
1986	-0.75	15.41	-8.81	-7.88	-1.13	1.98	3.96	-2.59	-4.81	5.52	1.47	4.00	0.73
1987	-1.70	10.66	-32.85	-6.22	-2.50	3.41	3.13	-0.36	-4.65	4.25	0.93	2.78	0.81
1988	-0.77	17.33	-34.12	-4.47	0.46	5.03	6.17	1.75	-4.71	5.65	-0.83	1.04	0.70
1989	0.17	22.89	-11.72	0.95	1.75	7.24	9.53	0.13	-4.27	10.28	0.85	0.26	1.43
1990	-1.75	15.37	-19.99	0.32	-0.71	6.17	5.73	-1.21	-3.94	4.60	-2.71	-0.63	0.54
1991	-1.56	16.39	-19.84	2.04	-0.45	4.46	5.67	-1.09	-3.12	5.52	-2.11	-1.08	0.52
1992	-2.26	8.30	-25.18	-2.74	-1.39	4.98	-0.90	0.38	-2.90	4.04	-7.50	3.76	2.05
1993	-2.04	9.04	-20.30	-6.07	-1.42	6.28	-1.10	1.08	-2.90	3.09	-10.11	5.07	3.23
1994	-0.68	9.95	-9.70	1.25	-0.93	8.42	2.34	1.43	-1.36	2.02	-8.52	5.89	3.96

Source: Own elaboration.
Note: Rate of Returnon Equities=Return on Equities or Family Farm Income/Own Capital.

9. Relevance in farm management diagnosis by a new information approach: towards a reference information system

Bernard Del'homme [1]

Abstract

Faced with increasing uncertainty as to the future, many farmers need, in order to make optimum choices, a regular evaluation of their farm's performances. To cope with a more and more uncertain environment, the farmer needs to evaluate the economic situation of his farm regularly, i.e. set up an economic diagnosis. For ten years, several advisory centres which are in charge in France of farm management diagnosis, use expert system to computerise such a diagnosis. They have found that the diagnosis quality mainly relies on quality of information used. And specially for a type of specific information: references. This was the aim of a study leaded at the E.N.I.T.A. with these advisory centres. The goal was to formalise a reference approach in order to build a new software, linked with an expert system, for producing automatically references adapted to the farm diagnosis, but also other uses of references in an advisory centre.

Such a reference approach is presented in this paper, then the steps for building a reference software is presented.

9.1 Introduction

As the Common Agricultural Policy (CAP) changes regularly, farm management has to adapt his way of reasoning to be relevant. At the beginning of the eighties, after reasoning on intensive ways of production, quotas and other restrictions have introduced more 'extensive reasoning' around the farm management. Then, in the nineties, environmental issues have grown up and opened new kind of management on the farm with, beside classical reasoning on production systems, diversification, sustainable farming or organic farming.

Nowadays, with the 2000 Agenda, uncertainty prevails: several ways of management are possible for a farm, and changes must be adapted very quickly to be successful. Production, marketing, finance have to be chosen in a harmonised way, and have to be evaluated regularly.

In order to be able to get such an evaluation of the farm situation, researchers and professionals have formalised methodologies for farm management diagnosis. These methodologies rely on modelling a management reasoning, then modelling information

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used in the reasoning, and at last give to the farmer a farm diagnosis which is used to manage the farm in a best way.

For ten years, several advisory centres which are in charge in France of farm accounting and management diagnosis (in this example ten offices, this means around 10,000 farms), use expert system to computerise such a diagnosis. It is based on technical, economical and financial indicators calculated on the farm (Del'homme, 1996) In order to improve the diagnosis, they have harmonised their diagnosis reasoning and their farm information system Such a work has successfully answered to the farmer's need of farm diagnosis, and has allowed a better farm management. This computerised diagnosis changes with the CAP changes in order to get a relevant answer to the farmer. But diagnosis quality also relies on the information used. Therefore, we have developed an 'information approach' (Steffe, 1999) to be able to modelise and computerise the farm information system.

However, in this 'information approach', we have distinguished 2 types of information used in a diagnosis: individual information on the farm and collective data called 'references'. And when we have tried to detail these references', what they are, how they are produced and used, we have founded a lot of differences between their producers and users. And we have quickly concluded that if we want to improve the diagnosis quality, we have now to focus on these information, which are not yet well analysed.

The aim of this paper is first to show how references are actually used and produced in advisory centres, and underline the different problems founded. Then, in a second part, we will present how a new information approach could be leaded around references in order to improve and computerise their production.

9.2 References in advisory centres: needs and problems

If we want to understand why references are an important step in an advisory centre, we have to clarify several points.

9.2.1 References: a definition based on its functions

An advisory centre provides accounting results (with juridical and fiscal calculations) and farm diagnosis to the farmer. Then, he uses data collected in its accounting activities for other uses. A study carried out in ten advisory centres has detailed the different uses of references (Ait Kaddour, 1997):

9.2.1.1 Group analysis

They are based on the comparison between farm results and results on a group of similar farms. The comparison is made to explain the farm situation towards the group, and to explain why farm results are situated at this level. In such activities, references are the data calculated on the different groups of farms.

9.2.1.2 Management diagnosis

In this use, the advisor compares farm results with results on group of farms in order to evaluate the farm results. The diagnosis realised is a commentary made on the farm accounting results. If we try to describe more precisely what is a diagnosis (Del'homme, 1996), we can distinguish four parts:
- presentation of the results of the farm;
- explanation of the results (why it has increased or decreased, why it is low or high);
- evaluation of the results (good or bad);
- cure proposed to improve the situation.

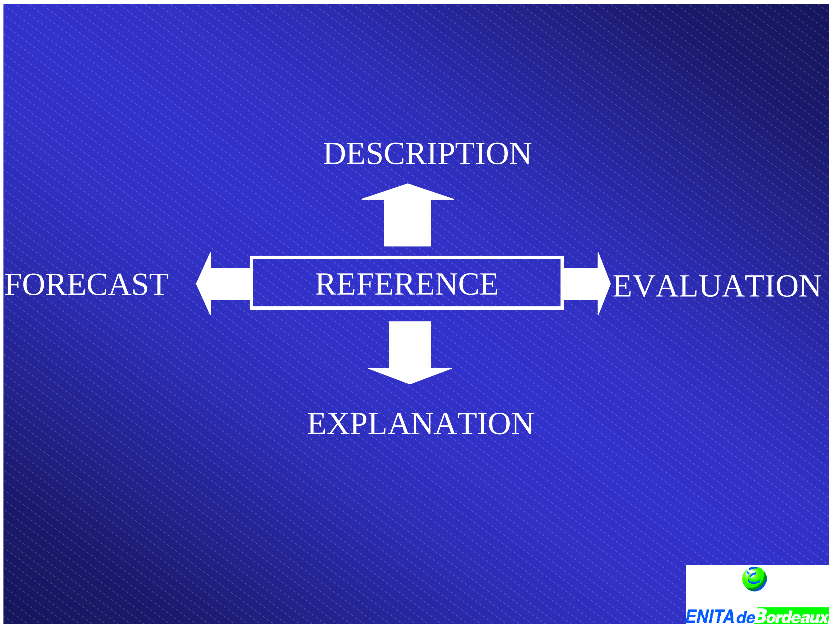
For building such a diagnosis, the advisor uses a methodology of reasoning on farm activities. This methodology relies on technical, economical and financial indicators which are produced on the farm results. References represent the value that the farm indicators should reach.

9.2.1.3 Other uses

Other surveys leaded on group of farms use references, which are results representing those group of farms in order to present a situation. Some studies can be based on forecast data.

9.2.1.4 Four main goals

If we summarise those different uses of references in a advisory centre, we can distinguish four different goals in which references are employed:



But the use of a reference is not the only way to define it.

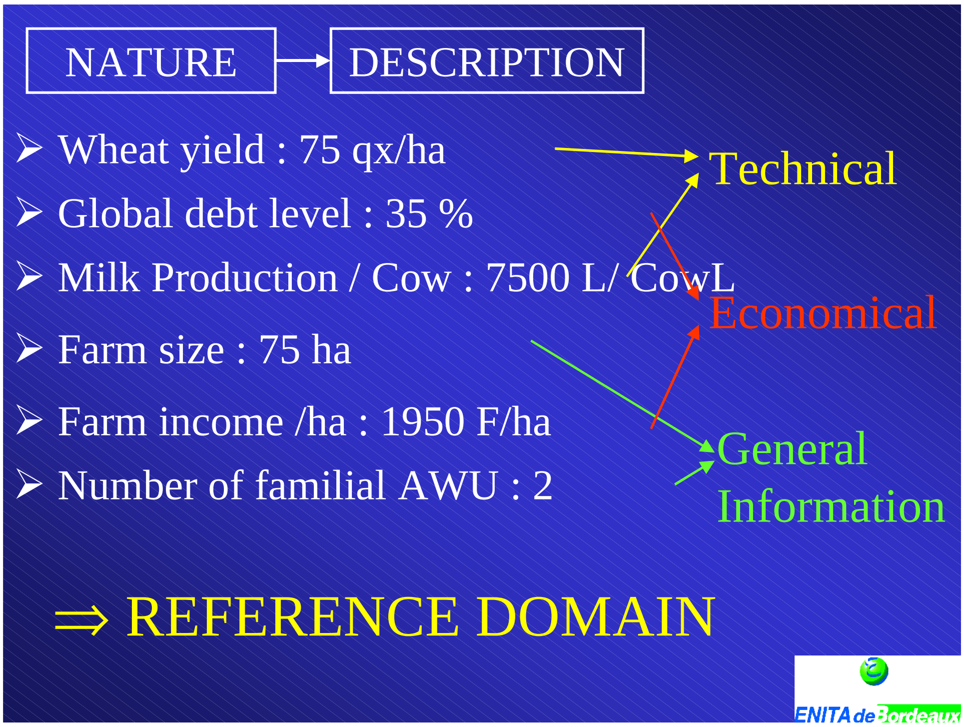
9.2.2 References: a definition based on the nature

If we try to define a reference, what is obvious is that it is an information in which several parts can be distinguished.

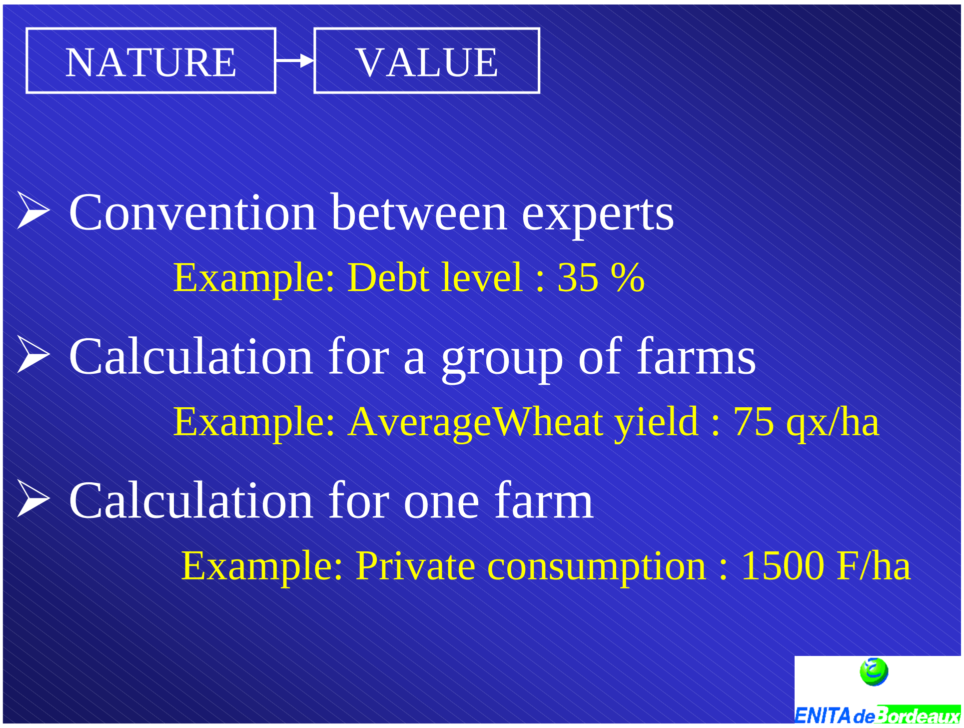
9.2.2.1 A description and a value

A reference is an indicator. Therefore, it has 2 main parts:
- a description (a name, a sense, a definition);
- a value (with a unit).

For the part concerning its description, it is possible to distinguish several domains where references come from. Three main domains concern references: technical domain, economical domain, and general information domain.



According to the value, three main cases can be founded. In most cases, a reference is issued from a statistical calculation (average) from a group of farms. But we also find values which come from a convention between experts of a domain and their reasoning of the ideal value. And we also meet references produced from one farm for several years.



What can be pointed out is the fact that these different fields of references have not really been taken into account in the centres. Most of them use only one methodology to produce their references, which is based on the 'group analysis'. They rarely have precise definitions of what references are and how should they are supposed to be used.

9.2.2.2 Several definitions towards single way of production

When we look for different approaches of references in management activities, we find several points of view who show complexity and diversity of this idea:

- a reference is an information, this means that we can distinguish in such information a material part (for example the name of the reference indicator, with it's definition), but also a conceptual part which includes the value taken by this reference indicator. So it is important to explain how the value has been determined;
- a reference is a collective information in most cases, this means it is an information which comes from a group (in our case a group of farms). The group of farms depends on what we want to show with the reference. The choice of a group, and then the calculation rules chosen are important for estimating reference quality;
- a reference has two mainly meanings
  - it is an information considered as a repair, an information which describes, characterises or represents a group. This means that the reference indicator has a value calculated from the group. Representativeness is an important criteria for such references;

- it is an information considered as an objective to achieve. This means that the value of this reference is calculated with this goal, which can be different of the first idea.

We can easily imagine that the two senses involve two ways of reference production. In fact, frequently, the two senses are confused, and the centres use a single way of production, even if they use references with the two senses.

Moreover, a lack of logical reasoning for reference production is the main idea resulting of our work. When it becomes more and more necessary to get a good references quality, quite no methodology has been formalised in the centres. Then, it is necessary to propose an improvement in the reference activities.

9.2.3 A reference approach for a better diagnosis

Our work is based on a theoretical idea: quality of a management diagnosis relies as much on modelling reasoning as on modelling information. This means that for a diagnosis improvement, it is now necessary to work as much on information as on reasoning. In our case, modelling reasoning on management diagnosis is already made, information modelling at a farm level is on a good way, but nothing seems to be clear for reference modelling.

Our goal is therefore simple: to formalise and computerise a reference information system in order to produce references in an advisory centre with a better quality. For this, we have to develop a methodology, then to test and propose a software product able to solve this problem.

9.3 Towards a reference information system

9.3.1 A single global methodology, specifical adaptations

When combining the different definitions of references, which come from the different uses in the centres, we have got the idea that each goal covered by a reference (description, explanation, evaluation and forecast) could need a specifical methodology. We also have thought that the 2 meanings given to the word reference could involve specifical calculation rules. Therefore, to be as much practical as theoretical, we have chosen to develop such a methodology with one domain, then the others.

Our first domain has been references for evaluation. We have in fact worked on the references used in the diagnosis management expert system developed in the centres. Then, we have worked on a second important domain, references for explanation, based on 'group analysis'.

9.3.1.1 For each domain identified, specifical adaptations are needed

We are illustrating this point in our 2 domains. References for evaluation.

If we work on references used in a diagnosis commentary, we can see that references are used to qualify the farm situation, when comparing it's own results with the reference. The qualification can be a situation qualification (good or bad level of debt for example), or an evolution qualification (your income has not enough increased or too much decreased). So the comparison with the reference indicator can rely on a judgement of situation, or on a judgement of evolution. This means that we need references for a situation's evaluation, and others for evolution's qualification.

We have also noticed that our references are quantitative indicators. Whatever the way it has been calculated, each reference indicator has a value. But as the commentary depends on the comparison between the farm indicator and the reference indicator, it is necessary to build several thresholds for certain values. For example, for the debt level, we have distinguished <25%, 25-45%, 45-55%, >55%.

At last, we have made a distinction between references which are common to all the centres and that we have called 'normative references' and references which are specific for each centre, that we have called 'standard references'. The calculation rules between these 2 types are mainly different, mostly because a normative reference includes often a subjective reasoning from the advisor. We have found in normative references the duality of the meaning: reference is based on a value characterising a group comparable, but also integers the objective that the farm should achieve. As a standard reference is only the characteristic value from a set of farms comparable.

Each sub-kind of reference for evaluation has been defined, then the sets where they are extracted have been described (we use the typology reasoning for this), then calculation rules have been chosen from statistical reasoning.

References for explanation

In this case, references are used to compare farm indicators with references indicators based on a set of farm. The goal of the comparison only should permit to the farmer to explain where he is situated in the group, and to explain why he is in this situation. But during the years, this type of analysis has became in the centres the only reference production methodology. Therefore, references produced for explanation have became references for all kinds of use.

We have first restricted the meaning of a 'group analysis' towards practises in the centres. A semantic work with a dictionary has been built in order to have a similar language. Then, the main questions for group analysis was which group to choose, and which reference indicators with which calculation rules to define.

Until now, group analysis were based on a single typology, which relies only on production systems existing, eventually crossed with geographical areas. What we have proposed is to be more flexible in the future. For technical and economical indicators, such a typology is relevant, but it must take into account the farm behaviour. For example, a dairy group of farms can be better described if we distinguish intensive dairy farms and extensive ones. This means more generally that we have to introduce behaviour criteria in our structural typologies for group analysis.

We have also proposed to build new typologies, for financial indicators, based on financial behaviour criteria (approach from multiyearly financial flows), and neglect for those typologies the farm production system. It is a real innovation, which allows new kinds of references more relevant for a group analysis. A group analysis is now based on 2 typologies, one for technical and economical indicators, one for economical and financial indicators.

Calculation rules for explanation references are also specific. In this case, we don't have a problem of meaning. A reference for explanation is clearly for characterising a set of farms. The particularity of a group analysis is that our set of farm (our typological group) can be separated in several sub-groups, which are separated with a performance indicator (often we build 3 sub-groups, the best one, the average one and the worst one). Then we find for each sub-group the calculation rule providing the best characteristic value.

As seen before, each domain analysed shows its particularities. But after more than one year of work, it is possible to describe a general methodology to produce references, whatever the domain concerned.

9.3.1.2 A global schedule for reference production

As much for evaluation references as for explanation ones, a schedule for producing references is able to summarise. We have found 9 stages:

1. choice of a study theme;
2. choice of a period for the study;
3. data disposability restrictions;
4. abnormal data elimination;
5. building typology;
6. key criteria selection to build sub-groups (facultative);
7. calculation rules for this study;
8. production of a document showing results;
9. commentary on the results.

As announced, a reference information approach is possible and allows better reasoning for reference production. When distinguishing several domains of references, then describing each domain, it is possible to build a general methodology which can be applied in all the domains. The next step is computerising this work.

9.3.2 Computerising such a methodology

The references described here are used in advisory centres, this is why a computerised solution should be at this level. This means that we have to gather all the data needed for reference producing. These data come from the different farms in the centres.

9.3.2.1 Building a relational database from a farm model

The great quantity of data needed, but also the different domains covered by the references has leaded to choose a classical software in such case: a relational data-base. The particularity of this one is that it is based on the quite same model as the farm relational database we have already developed. This characteristic allows a high integration of all the data produced at a farm level in our software, even those that we don't yet need. We have only add some new tables of data for gathering all the references which are not issued directly from the farm information system. We have also build tables for keeping the references values themselves, depending on the domain they come from. At last, we have built our base with an evolutive idea, this means it can support new data easily. The tool chosen uses SQL technology. It allows the possibility to choice all kinds of data and select all kinds of farms needed.

9.3.2.2 Links with statistical applications for calculations

Once our set of farms and data selected (we are on the stage 6 of our schedule), we have to link our relational database with another software, based on statistics to realise the last stages. The goal is now to produce our references by calculation, and to give results in a presentation adapted. If we have formalised our approach (it is the case for evaluation references and explanation ones).we can realise specific requests in our statistical software to computerise calculation. But we must take into account that for particular analysis, we don't know yet the methodology to follow. Our software must therefore allow manual manipulations, and propose to the user a set of different statistical calculations. Multicriteria analysis is for example requested for such further work.

One other important point is to realise graphics presentations of our results. Boxplots seem in this case an interesting method to show clearly distribution of a phenomenon. Several software products can answer to these specifications. We have chosen to develop our application with a commercial product, better than building one ourselves.

9.3.3 Perspectives

We have finished our methodological work for the 2 domains described before during the 1999 spring. We are now preparing our relational database, with a problem of integration of the different data sources in the centres.

We are testing several statistical software products in order to choose at the end of the year. We have now to develop methodologies for presentation references and for forecast references. And we have to begin our work of computerising those methodologies in our software products. It should take one year.

Then, we will come back to our main activity: farm management diagnosis, which should be improved by use of new references.

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10. Evolution of the farm environment: the need to produce a general information system

Jerome Steffe [1]

Abstract

There has been considerable evolution in the relationships between the farm and its environment (administration, advisers, suppliers ...) as well as many developments in technology, such as EDI and Precision Agriculture. This means that the farm information system has considerably evolved in the last years. Most changes have been individually integrated into the structure of the farm information system.

The overall coherence of the system was also no longer ensured, raising many problems in on-farm data management.

All this has prompted a review of the notion of the farm Information System.

In order to better understand the new farm environment and to better meet the new end-user information demand, a general information system for farming has been designed.

For design purposes, a preliminary study was carried out at the ENITA de Bordeaux (Enita is a university level agriculture institute. One department of the institute is the 'Information System Laboratory', which develops software products) to identify needs. The general information system was structured so as to avoid multiple keying of information while integrating current information and providing for future needs.

Keywords: Farm management, Management Information System, Data modelling

10.1 Introduction

Some ten or fifteen years ago, computing was presented as a true revolution in the history of agriculture, similar to the introduction of farm machinery in the sixties. Today, however, using a computer is no longer seen in itself as a solution for the problems of farm management. Farm management software products must evolve to a new stage taking into account recent evolution in demands of end-users (traceability, precise production costs, mineral balance …). This is all the more timely as Information Technology is opening new perspectives.

In France, there are numerous specific products for farmers: software for accountancy, for forecasting, crop management, herd management ... . This situation can be explained by market history because all software developments have been, above all, 'ad hoc', in response to a specific management problem. Everyone adopted a sectorial ap-

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proach in meeting demands. Problems were solved sequentially and each program was developed independently. In France, there are more than 250 agricultural software products on the market. The software interfaces between these products seldom exist. This means that the farmer is often forced to type the same data twice or thrice! In this case, there is not only a huge waste of time but also another problem: the coherence of data is not ensured.

The information system of the farm must be better integrated to offer the farmer the necessary overall response to his problems.

This is all the more necessary as the increasing complexity of the environment of the farm makes these problems more acute.

This increased complexity can be ascribed to: the evolution of legislation, more numerous and complex relationships with external actors, the new organisation of the agricultural market (EDI …), new boundaries of the farm (new alliance strategies, new structures …), the diversification of activities.

Due to these different changes, the environment of the farm has become more and more complex. Information flows have rapidly increased and their nature is rapidly evolving.

To face the increasing complexity of the farm environment, the information system should adapt and take into account this paradox:

- it should include more and more information;
- it should avoid multiple keying of the same information.

In 1997, an internal study was carried out by four accountant offices showed that multiple keying of information was one of the main factors of productivity loss in their organisation.

Unhappily, no study was carried out with farmers to see if they also had identified this problem. Nevertheless, from the experience of accountant offices, it can be said that farmers are aware of it, but that they find the problem bearable if results are produced.

In its current state, farm data management needs to integrate data registers of various farm software items into a single database (herein called the general information system). The originality of our approach consists in the methodology used to identify information needs and to structure the information system.

Instead of integrating existing databases and programs into one system, a totally new system was designed and, consequently, a totally new software product.

In this paper, the method used to structure data will be presented, indicating how to avoid multiple keying of information while integrating the future evolution of information needs.

10.2 General presentation of the methodology used to define a general information system for the farm

At the beginning of 1997, in order to set up a general information system, a study was carried out at the 'ENITA de Bordeaux' to identify what the new needs of the farmers were. This study was continued in 1998 with the help of four accounting offices.

The final goal of this research was to implement this model through the development of multi-function software for farm management.

The study was limited to the farm management information system (MIS) as it would have been too complex to work simultaneously on the MIS and the Technical Information System (TIS).

Methodology defined to truly include the end-user in the conception of the new MIS was set up. This methodology was broken down into three stages:

1. *identification of all kinds of end-users*

   The 'ENITA de Bordeaux' develops Management Information Systems (especially for accounting) aimed at two kinds of users: farmers and accountants.

   Even if these two categories of people do the same work (they enter farm accountancy data), it is clear that they do not work in the same way and that each has very specific needs;

2. *delineation of domains*

   The Management Information System includes a great amount of data. It was therefore necessary to divide the study of this system into several sub-domains. First, this made the understanding of the problem easier. Secondly, the study involved people specialised in one (or two) sub-domain(s).

   In our study, it was decided to split the MIS into 7 sub-domains: general accountancy, analytic accountancy, analysis of collective data, crop management, animal production management, environmental data, commercial management;

3. *setting-up of the model*

   The project was divided into 7 stages:

   1. preliminary study for each sub-domain

      This stage was carried out at the 'ENITA de Bordeaux'. The result is a description of each sub-domain (including defining of the limits) and a presentation of all treatments which are provided in this domain (a process model);

   2. detailed description of each sub-domain

      By means of interviews with researchers and some farmers (around 1 hour for each interview), the description of each sub-domain was improved. A document explaining each process was realised;

   3. interviews

      50 people were interviewed. They were not randomly chosen. For each sub-domain, a list from 8 to 10 'specialists' was fixed. Each person was interviewed for 3 or 4 hours. The general presentation of their domain and the guideline for the interview had been sent one week before so that they could prepare the interview. During the interview, the process model was discussed in order to identify missing or problematic processes. In each case, the process concerned was described in detail so that necessary sub-processes or data could be identified. A document for each process was also written, or corrected, or validated. Finally, general questions about EDI, Internet, ergonomy ... were asked for all domains;

   4. synthesis of each interview

      Immediately after each interview, a compilation of all answers was written up in order to improve all documents and the general remarks of each person interviewed were also documented. The compilation and remarks were then sent back to each person for validation;

5. modelling of each sub-domain
   By means of the interviews and their validation, all process models were corrected and a general synthesis was written up;
6. presentation of results to persons interviewed
   A meeting was organised with all interviewed people (50% attended) to present and to discuss results. Remarks were taken into account in carrying out the next stage;
7. final modelling of each sub-domain and modelling of the general MIS of the farm
   This stage began in February 1997 and finished in September 1998. Its aim was to write the process model and the data model for each sub-domain and to synthesise all these models to produce one single, general model for the farm.

   Special attention was paid in this phase to separating the data model from the process model. The modelling had, indeed, to be general enough to be applied to any management method. The model has been set up in such a way that it is possible to integrate new information without any change of the structure of the model.

   This work was done at the 'ENITA de Bordeaux' and validated by 4 accounting offices. The methodology used was the 'Merise method' (Nanci, Espinasse, 1994), a French method for modelling an information system, based on the relational database approach.

   All data models were commented on, then validated by researchers of the ENITA de Bordeaux and by people working in the accountant offices. Three working groups of five or six people conducted 40 one-day meetings (This number does not represent the extra work done by each member between two meetings) at this stage of work;
8. implementation of the model: the development of the multi-function software
   The final goal of the project was to implement the general information system through a multi-function software. This implementation was very important because:
   - it was a real test of the model;
   - it was a way to deeply include the end-users in the conception of the model.

The work was done with a group of four accounting offices (who supply 12,000 farmers with services and advice) and the total budget of the project was around 1,5 million Ecus. Thus, the end-users had a real interest in participating actively in our project.

As of April 1999, the main part of the software (general and analytic accountancy, general information on the farm, stock management) has already been developed and tested.

The other parts will be developed later in 1999, especially those concerning commercial management and environmental data.

10.3 Methodology used to structure the data

This aspect of the methodology used will be developed as it constitutes the originality of the approach conceived. The intent is to demonstrate how it is possible to generate a general information system covering not only current but also future needs.

Three main objectives were identified in the setting up of the general information system:

- a great variety of needs had to be met;
- all had to be integrated into a single database;
- future evolution in information needs had to be easily integrated into the model without structural changes.

10.3.1 Identification of various needs

The general information system as defined should include all data which are necessary to farm management. It necessarily includes responses to a great variety of needs stemming from different farm activities and different management methods.

To identify all responses necessary, the process model of each sub-domain was set up after consultations with specialists and also professionals (see general presentation of the methodology). The objective at this stage was not to model the decision making processes but to list all data which are used in farm management. The study of the processes was carried out only to identify necessary data.

This separation between data and processes is crucial in our methodology because data, as defined, constitute the static part of the information system whereas processes are in constant evolution. Moreover, most data are common to all farms whereas some processes are specific to some farm activities. The main evolution in data needs identified during this study was traceability, greater precision of records (mineral components, and more generally all characteristics associated with a product) and better management of data history.

At the end of this stage, the data dictionary of the general information system was defined.

10.3.2 Integration of data into a single database

The setting up of the model included two constraints:

- all data had to be modelled;
- each piece of information had to be stored in a single place in the database. This avoided multiple keying of the same information. Of course, even if data is stored in several places in a database, it is possible to avoid multiple keying (once the information is keyed, it is automatically copied to all relevant places in the database) but this raises some problems of coherence.

Due to the second constraint, it was impossible to integrate existing models into one single database. Therefore a totally new model was set up. The difficulty consisted in avoiding multiple modelling of the same information.

For example, in the animal production sub-domain, an entity (An entity is the modelling of a set of concrete or abstract objects, which have the same nature and the same attributes.

An attribute is the modelling of an elementary information 'Animal' was generally defined. In the general accountancy sub-domain, an entity 'product' was defined. This constituted a redundancy in modelling because an animal was modelled twice (an animal is considered as a product in accountancy). Thus, there were many redundancies when different models were integrated or when a model was set up at the sub-domain level.

The only way to avoid multiple modelling consisted in working at a general level and reaching a higher degree of conceptualisation in the definition of entities. In the example, a single entity 'element' was modelled (an element is a product as well as an animal). It was possible to give such a definition because a product and an animal have some common attributes (code, name, unit …). To set up the model, all entities were compared two by two: if there was the slightest risk of redundancy, the two entities were combined to create a more conceptual (abstract) entity. This method required a truly systemic approach; this explains why it is impossible to keep definitions of existing models in a single system.

10.3.3 How to integrate future evolution in the designing of the model

Costs for designing and setting-up an information system are very high. Designing a non-static model to meet both current and future demands was, therefore, the objective.

Attaining this objective meant a high degree of conceptualisation in the modelling.

For example, instead of modelling an entity 'mineral component' (to calculate a mineral balance), an entity 'element characteristic' was created. Mineral components are, indeed, a specific characteristic of an element. Other characteristics were defined with the same attributes: 'Name of characteristic; Unit of characteristic; Format of characteristic (numeric, text …)'.

Such a case arose for example for the fat content of hog, butter content of milk, percent of alcohol for wine … . Instead of creating an entity for each kind of characteristic, a general entity 'element characteristic' was created and the different characteristics were identified with a type.

Definition of the entity: 'Name of characteristic; Unit of characteristic; Format of characteristic; Type of characteristic'.

Mineral components were, therefore, defined as a specific type of characteristic. With this system of entity typing, it became possible to add as many mineral components as needed as well as some new types of characteristics ('animal characteristics' could be another type). These changes occurred without any change in the structure of the database.

Moreover, the decision to operate with a high degree of conceptualisation made it possible to integrate the history of values for all characteristics (see Figure 10.1).

All entities in the model were defined as described above. For example, the system did not include an entity 'person' but an entity 'actor' (an actor is either a person or a firm) and the attributes of this entity were the 'code of the actor', 'the name of the actor', and the 'type of the actor'. To store data related to a person, an entity 'actor characteristics' was created (with the same structure as 'element characteristic').

Static design	Flexible design
Product <u>Code</u> Name Unit Nitrogen rate Potassium rate Phosphate rate	**ELEMENT** <u>Code of element</u> Name of element Unit of element **ELEMENT CHARACTERISTICS** <u>Code of characteristic</u> Name of characteristic Unit of characteristic Format of characteristic Type of characteristic **ELEMENT DETAIL** <u>Code of element</u> <u>Code of characteristic</u> Value of characteristic Beginning date End date Nitrogen, Phosphate and Potassium are considered as an 'element characteristic'

Figure 10.1 Example of differences between a 'static' design method and a 'flexible' one

This avoided static modelling of the type as follow: 'Code of actor; Name; Sex; First name; Birth date; Maiden name'.

In this kind of modelling, if a new piece of information is needed (for example the place of birth), it is necessary to change the structure of the model. In our case, this new piece of information is merely a new characteristic (such as sex, first name, birth date …) and is already defined in the database.

Due to this high degree of conceptualisation and to the use of entity typing, the general model was set up without redundancies and with a high degree of flexibility.

The risk of such a design was to set up a theoretical model which could not be applied. That is why particular attention was paid the validation process.

10.4 Validation of the model

To ensure the feasibility of using the model, the latter was translated into a software product, which constituted the final stage of the validation process.

Three levels of validation can be distinguished:

1. *validation of the model by the working groups and definition of the software functions*

   After the interviews, a first version of the model was produced and then discussed with people working in accountant offices.

   The objective of this stage was, first, to complete the model. All management methods were studied to ensure that all data which were necessary to the farm management were integrated into the model. Then, the structure of the model itself was discussed. The relevance of entity and attribute definitions was verified. Around twenty people from accountant offices and researchers from the ENITA de Bordeaux participated in this stage. Forty meeting days were organised. At the end of this stage, the functions of the software product (based on the general information system) were definitively defined;

2. *setting up of the software product and tests*
   A team of programmers began to work on the production of the software in April 1998. The first module was produced in July 1998. It was then tested by 50 accountants and 10 farmers.

   For all modules, testers verified to see if all the information necessary for farm management was present and if the functions of the software products were relevant.

   Three kinds of problems were identified:
   - lack of information;
   - bugs in the program;
   - possible improvements in the software product.

   Each problem was written up on a special data sheet and was then treated by the team of designers or programmers. Since July 1998, around 3,000 data sheets have been treated.

   Only a few data sheets concerned the lack of information. In almost all cases, the flexible design of the model allowed the designers to integrate the new information without any change in the structure. The structure had to be changed only four times and there were only small changes made. This was the proof that the model made it possible to integrate new information;

3. *using the software product*
   Some modules of the software product have already been finished (general and analytic accountancy, general information on the farm, stock management). In 1999, almost all the 12,000 accountancy dossiers of the four accountant offices will be managed with the software.

   Other accountant offices are also interested in the software and some contracts have already been signed. Moreover, the software developed will replace the previous product of the ENITA de Bordeaux which is currently used by 5,000 farmers and by some other accountant offices (which represent around 6,000 additional farms).

10.5 Consequences for farm management

The setting up of a general system presents two main assets:

It improves the quality of information

The elimination of redundancies means that each data will be entered only one time. The user is, therefore, sure to deal with the latest content of the data items when the latter is used to produce a result. This point is very important because it was noticed in several accounting offices that people never assess the relevance of information and just consider it as a 'raw material' to produce their diagnosis. However, the assumption can be made that the more the quality of information is improved, the better the management diagnosis is.

At last, the elimination of redundancy has a direct effect: a higher productivity in the data entry.

It points out some new possibilities for farm management

Contrary to partial information systems, the designing of a general information system makes it possible that several management methods work on the same data. The use of some data becomes, therefore, no longer specific of a sub-domain and could bring some added value to other sub-domains.

At the present time, there are a lot of researches in precision farming to produce a yields cartography, a technical itinerary … but the data produced are not integrated in the management information system of the farm.

Nevertheless, the data produced would be of a great help for example in the domain of 'analytic accountancy'. Some direct applications of such an integration of these data in a general information system can be mentioned:

- it would be possible to know what products have been used in the farm, at what date, with which quantities and on which crop;
- harvests will be automatically known per crop and per parcel;
- a lot of data related to working time measures will be easily known;
- … .

If data related to precision farming were integrated into a general information system, it would, therefore, be possible to automatically generate a great part of the analytic accountancy.

It would not only offer a gain in time but also an improvement in management because the farmer is, today, rarely able to provide the accountant with such precise information.

Precision farming is just an example of the possible uses of the general information system for farm management.

At the present time, the ENITA de Bordeaux is working on a project in association with a machinery firm in order to test the integration of data collected by an on-board computer in the general information system. The tests carried out in February 1999 were a success and showed that it is possible to integrate data related to precision farming into the system.

In conclusion, it can be said that the design of the general information system improves the quality of information.

The assumption may also be made that it improves management itself:

- using a raw material of a higher quality (updated and non-redundant information) makes current management methods more efficient;
- a single general information system facilitates data transfers between management methods (the results of working time measures can be directly used in analytic accountancy …);

- some new management methods can use the data modelled. The modelling is, indeed, not connected to the processes and the development of a new management method will not be limited by the problem of information availability.

10.6 Conclusion

The complexity of farm management has become ever greater and information needs are evolving faster and faster. Farmers and advisors no longer accept several tools to carry out management but want a general product which produces time gains, simplifies the management situation and integrates possible future evolutions. To meet this demand, it is necessary to set up an integrated tool based on a truly systemic approach.

This requires the design of a flexible general information system for farm management.

Such a general system improves not only the quality of information but also offers some new possibilities in farm management.

The risk in the project developed at the ENITA de Bordeaux was to set up a very theoretical model. To ensure the feasibility of the model, the latter was translated into a software product. This meant associating end-users with the design of the system. Even if this kind of project proved to be costly and lengthy in the first stage, attention given to the design phase should produce a reduction of the costs during the maintenance phase (which are most often underestimated).

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11. Tax accounting versus management accounting

Knut Samseth [1]

Abstract

Is it worth the trouble of preparing management accounts, and using these as the basis for farm management counselling, instead of tax accounts? This article takes a look at differences between the two accounting principles. One of the results is that the differences vary between farms and productions.

Keywords: Tax accounting, management accounting, Accounts statistic, valuation, accounting methods

11.1 Introduction

A large number of persons and interest groups utilise farm accountancy data, e.g., farmers themselves, advisers, creditors and tax authorities.

The Tax Assessment Act (Act of 13 June 1980 no. 24 on tax assessment administration) imposes accountability or simplified accountability in farming, forestry and horticulture. Accountability in other industries is mainly regulated by the Accounting Act and the Companies Act. Agriculture is more or less the only trade which isn't obliged to keep accounts pursuant to the Accounting Act (Act of 13. may 1977 no. 35 on accountability etc.).

All farmers that have a production exceeding a certain minimum volume, have either complete financial statements or a simplified annual account. In this article, both of these two types of accounts are referred to as tax accounts.

It has been generally accepted for quite a while that the tax regulations disagree with what would be considered best with regard to managerial considerations. Agricultural economists have therefore encouraged farmers to prepare management accounts. Nevertheless, only relatively few farmers have done so. Annual management accounts are compiled for the approximately 1,000 farms participating in NILF's [2] Account Statistics in Agriculture and Forestry. The Account Statistics are based on tax accounts that are transformed into management accounts following established rules. These rules serve as templates for most of the management accounts prepared by others.

The total number of farmers using management accounts at present is unknown. However, in a survey by Hatteland & Knapskog (1993), accountants stated that in 1991, 12% of their customers had either partial or complete management accounts prepared. If

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management accounts are better than tax accounts as a basis for financial analysis in agriculture, why are so few farmers using them?

11.2 Are there only minor differences?

It has been claimed that the difference between management accounts and tax accounts is insignificant over a period of time. When regarding the results over a number of years, the difference thus becomes small. A similar problem is encountered when evaluating accounts kept according to the cash accounting method versus the accrual accounting method (Seger and Lins, 1986). Tax regulations have undergone many changes during the past years, resulting in tax accounts becoming more similar to management accounts.

If the two account forms give about the same results, tax accounts can be just as good as management accounts as a basis for financial assessments. We have not found any studies that examine how big the differences are regarding actual results between tax accounts and management accounts.

In a previous study, Samseth (1996) found that especially part-time farmers chose lower tax levels by using the dual income tax system (split income model). In other words, they had a greater tendency than other farmers to choose maximum return on capital. Through investment practice and choice of depreciation rate in reducing balance (method of) depreciation, farm managers can influence their taxable income as well. Costs can vary between tax and management accounts, in part due to the 'Account Statistic's' use of straight-line depreciation. It would be interesting to examine whether or not these differences are the same for part-time and full-time farms.

The objective of this article is to examine:

- the differences between the measured results from tax accounts and management accounts;
- if the differences are greater for part-time farms (cereal production and sheep farms) than for full-time farms (dairy);
- if the differences become less over a period of time;
- which accounting items create the differences.

11.3 Definitions

Management accounts are defined according to the standards used by NILF in the Account Statistics (NILF, 1997). These are used for a number of purposes, including to a certain degree the evaluation of Norwegian agricultural policy. Also, the Account Statistics are used by farmers and advisers in the preparation of financial analyses. The results are thus used both as internal accounts and as external accounts.

In this article, 'tax accounts' is used in the sense of 'income statement on businesses for taxation purpose'.

Furthermore, we do not distinguish between full-time and part-time farms, and rather make use of the type of production as an indicator. Dairy farms are regarded as full-time farms, whereas cereal and sheep farms are regarded as part-time farms.

It would be interesting to compare the principles used in the 'Account Statistics' with the rules and recommendations for good accounting standards which apply to financial accounts. It would also be possible to compare with the principles for management accounts used in other trades. However, these aspects are not dealt with in this article.

In this article we thus concentrate on studying the differences between management accounts according to the principles used by NILF and tax accounts.

11.4 Transforming tax accounts to management accounts

In tax accounts the results are in principle calculated in the following manner:

Annual income
\+ outgoing balance
\- Annual costs
\- incoming balance
= Net income

Only those items applying to the business in question are included. In management accounts the inventory value changes are allocated to the relevant types of income and costs, and production income and costs are calculated for various income and cost categories. The allocation is not quite the same in the two types of accounts. However, the net income in tax accounts and net income in management accounts could be the same in spite of different income/cost group divisions (Giæver, 1976, p. 23).

	Management accounts	Tax accounts	Net operating income
	Net income, farming	'Profit transferred to tax return'	✔
+	Net income, forestry	'Profit transferred to tax return' [2]	✔
+	Net income, other occupations	(Can be included in the other 'profits')	✔
+	Wage income and pensions	Wage income and pensions	
+	Family labour investment	(Usually not placed to account?)	✔
+	Capital income	Capital income	
=	Total labour compensation and payment of interest		
-	Cost of capital	Cost of capital	
-	Provisions for retired farmer	(Included in 'profits ...')	✔
=	Total net income	Total net income	*net operating income*

Figure 11.1 Total net family income in the Account Statistics and in tax accounts. Items marked # are included in 'net operating income'

Both the Account Statistics and tax accounts include more than just farming operations. The results of management accounts (NILF, 1997; 22) and those items of the tax accounts which correspond closest, are presented in Figure 11.1.

The management accounts' 'Total net income' has no direct parallel in the tax accounts, but the term 'general income' is closest. Nevertheless, the table shows the similarity between the accountancy terms in the two systems. The figures for provisions for retired farmer, capital costs, capital income, wage income and pensions are not changed in the transition from tax accounts to management accounts. However, the provisions for retired farmer are regarded as an operating cost in tax accounts, but are treated as capital costs in management accounts.

In tax accounts it is optional whether or not to include family labour investments, e.g., in connection with the construction of new farm buildings. They are either recognised on the balance sheet and subsequently written down, and at the same time recorded as income in the investment period, or they are disregarded. Andersen and Teigen (1995, p. 100) claim that in most cases any labour investments are not recognised as assets in the tax accounts. This is assumed in the following analysis.

If we limit the analysis to farmers with no other taxable income than from agriculture (i.e., farming and forestry), it is an easier task than when including farmers with other commercial activities in addition to agriculture. This results in only two income statements on businesses in the tax accounts. However, in the Account Statistics, these remaining activities are still three separate businesses: farming, forestry and 'other occupation'. In this analysis we will now treat these as one income statement in both tax accounts and in management accounts.

If we do not include capital income, cost of capital, wages and pensions in the comparison, since they are the same in both types of accounts, a comparative measure can be created which we call net operating income. The net operating income consists of the total asset value and the total income and costs/expenses for the various businesses.

We have mentioned that 'provisions for the retired farmer' is posted differently in tax and management accounts. Another example of differences in accounting practice is the farm dwelling. In tax accounts, maintenance of farm dwellings is considered a normal operating cost in agriculture. A 'rental income' is calculated and posted as an income. In the Account Statistics, income and costs related to the farm dwelling are posted as household consumption.

Giæver (1976, p. 21-22) points out that tax accounts may contain errors that farmers are knowledgeable about in order to avoid taxes. The Account Statistics correct such errors as long as they are known. We assume that there were no such errors in the tax accounts for the years and the farms in the study.

Necessary adaptations in the transition from net operating income in tax accounts to net operating income in management accounts are shown in Figure 11.2.

In both types of accounts, the purchased inventories are valued according to the FIFO principle. Self-produced inventories for sale are valued according to standard rates for costs in tax accounts and by their market value in management accounts. In the case of quantitative changes from opening to closing balance, different rates for valuation of inventory and livestock result in greater differences between the two types of accounts than otherwise.

		Items for adjustment	Items in tax accounts (farming and forestry)
	C	*Net operating income in tax accounts*	*Item 459 (and corresponding calculation for forestry)*
+	I	Adjustment for income	Item 261 (total expenses in trade)
-	U	Adjustment for costs	Item 359 (total income in trade)
+/-	B	Adjustment for changes in the depreciable asset values	Items concerning asset group C, D and G
+/-	Br	Adjustment for changes in remaining asset values (recognised in the tax account)	Items 422a and 422h minus items concerning asset group C, D and G.
+/-	Rest	Provisions to retired farmer, household consumption, gains and losses, etc., and net value of I, U, B, Br - adjustments necessary to nullify the result	Items 285 (Total capital costs), 384 (Total investment income), etc.
=	A	Net operating income in management accounts	

Figure 11.2 Items used in the adjustment from tax accounts to management accounts. Sum farming and forestry

11.5 Material and methods

This study is based on 99 farms that participated in the Account Statistics from 1993 to 1996. Eighty of these are more or less pure dairy farms, and a total of 17 are either cereal or sheep farms. None of the participating farms have other commercial businesses than farming or forestry, but the members of the farm family may have wage income. The surveyed farms represent a typical selection of all the farms in the Account Statistics, given the requirements to farm type and commercial activities.

Tax data is taken from the tax account before public tax audit. No considerations have thus been taken to any corrections that may have been made by the tax offices.

In order to analyse the differences between tax accounts and management accounts, the differences were estimated as 'normal' averages and as averages of absolute values. The latter enables the presentation of the total variation, without the equalising effect of negative and positive results.

The average difference is defined as

Equation 1

$$\frac{\sum_{i=1}^{n}(C_i - A_i)}{n}$$

and the absolute average difference is defined as

Equation 2

$$\frac{\sum_{i=1}^{n} \left| C_i - A_i \right|}{n}$$

Both C and A are net operating income. C is taken from the tax accounts for farm i and A from the management accounts for farm i, while n represents the number of observations.

Regression analysis is used to analyse the relations between tax and management accounts.

11.6 Income variations

On average, the tax accounts result in higher income than the management accounts for the 99 farms (see Table 11.1). This applies to all years of the study.

For some farms, the resulting differences were positive, for others, they were negative. When computing absolute difference, the total difference is shown, without regard to positive or negative values. Thus, the average difference between tax accounts and management accounts is best illustrated by using absolute values. The absolute average difference for all years is NOK 44.510. This is equivalent to 21% of the management account income (A).

Table 11.1 Average net operating income of tax accounts (tax) and management accounts (management). Average difference between the two, expressed as non-absolute and absolute values

Year	Average net operating income		Average difference: tax - management	
	tax-accounts (C)	management-accounts (A)	non-absolute	absolute
1993	231,338	229,726	1,611	44,093
1994	232,562	213,196	19,366	49,353
1995	222,282	204,048	18,235	47,129
1996	220,865	206,086	14,779	37,674
Average a)	226,816	213,406	13,409	44,510

a) Average for all observations and all years.

In order to further test for significant differences between the two accountancy types, a regression analysis was carried out using the following model:

Equation 3

$$A = a_0 + b_1 C$$

The results for the entire data for all years show that (standard deviation in parentheses):

Equation 4

$$A = \underset{(7075)}{36025} + \underset{(0,029)}{0,78}\ C$$

The null hypothesis is that b1 =1 and a0 = 0, implying that no difference of net operating income between tax and management accounts is expected. The alternative hypothesis is that b1 ≠ 1 and a0 ≠ 0. The T-statistics of the coefficient b1 (27,205) implies that the null hypothesis must be rejected. The constant term is also significantly unequal to zero. The net operating income can thus not be considered the same in the two accounting types.

In Table 11.2, the selection of farms is divided into two categories; dairy farms at the top, and cereal and sheep farms at the bottom. The cereal and sheep farms are presented as one category since there only are few farms in each of the groups, and both are typical part-time operations.

Table 11.2 Average net operating income from tax accounts (tax) and management accounts (management). Average income difference expressed as non-absolute and absolute values. Farm categories: dairy versus cereal and sheep farming. N = number of observations

Year		Average net operating income		Average difference: tax - management	
		tax-accounts (C)	management-accounts (A)	non-absolute	absolute
Year	N				
DAIRY					
1993	80	247,774	244,096	3,678	44,315
1994	80	241,544	228,172	13,372	45,047
1995	74	242,936	217,633	25,303	46,173
1996	80	234,842	218,575	16,267	37,314
Average a)	314	241,752	227,300	14,452	43,887
CEREAL AND SHEEP					
1993	17	160,496	170,685	-10,188	45,703
1994	16	172,931	142,487	30,444	52,088
1995	17	137,654	142,518	-4,864	41,264
1996	17	150,658	146,608	4,050	36,498
Average a)	67	155,174	150,695	4,478	43,766

a) Average for all observations and all years.

The Table 11.2 shows that the average income is higher on the dairy farms than on the part-time farms, and that the income difference between tax accounts and management accounts is greater among the dairy farms.

A regression model similar to the one presented above, but including a dummy variable for dairy production, also shows a significantly greater income difference between tax accounts and management accounts for dairy farms than for the others.

The absolute income differences are about the same for both farm categories. Relative to the net operating income from management accounts (A), the income difference between the two account types is greatest for the cereal/sheep farm category (29%). For the dairy farms, the same relative difference is 19%.

It can therefore be concluded that it is difficult to make use of tax accounts as a reliable basis for analysis and management planning in these productions.

11.7 Do the differences diminish over a period of time?

One of the causes for the income difference between tax accounts and management accounts is the difference in depreciation principles. When studying any single farm over a period of time, the total nominal depreciation should be the same irrespective of the method applied.

However, a period of four years is not sufficient in order to expect the same total depreciation in tax accounts and management accounts. Nevertheless, one should expect the differences to be less for the entire four year period than when only regarding a single year.

This is confirmed in Table 11.1, in which the overall average figure is clearly lower for the non-absolute values than for the absolute values. For this selection and period of time, the difference was also less when regarding the overall, four-year average than when regarding each of the years on its own. This is clearly shown in Table 11.2.

The following equation shows an average absolute difference for all years for each farm *i* (n=99).

Equation 5

$$\frac{\sum_{i=1}^{n} \left| \sum_{j=1}^{4} C_j - \sum_{j=1}^{4} A_j \right|_i}{4n} = 31358kr$$

Over a period of time, the results can here possibly nullify each other on each farm. In comparison, the overall absolute value (Table 11.1) is NOK 44,510. For this selection and period of time, the difference became smaller.

Observations of individual farms allow for the study of the actual figures making up the final result. The farm with the maximum net income difference between tax and management accounts had an average difference of NOK 124,412 over a four-year period. The four-year net income averages for the two accounting types were NOK 304.657 and NOK 180,245 for tax and management accounts, respectively. The total (sum) of the differences for all four years amount to nearly one half million NOK (NOK 497,648). The income deviations for this farm represent 69% of the total net operating income in the management accounts A (all four years). The two farms with the largest and smallest net operating income differences were both dairy farms.

11.8 Which factors create differences?

We have taken a look at income differences between tax and management accounts. The differences are the sum of several adjustments made when transferring tax accounts to management accounts, see Figure 11.2.

Table 11.5 presents the average annual and overall adjustments, and shows especially whether these have an overall positive or negative effect. The absolute numerical values are not especially relevant due to the equalising effect of positive and negative results.

In addition, the table also presents the effect of each item Z relative to the net operating income in the tax accounts for each observation i, as shown in equation 6 for a single year.

Equation 6

$$\frac{\sum_{i=1}^{n} \frac{\left(Z_i^C - Z_i^A\right)}{C_i}}{n} \cdot 100$$

where Z are items I, U, B, Br, Rest used in the adjustment from tax accounts (C) to management accounts (A), see Figure 11.2.

This is a measure for the results that would be achieved if this factor Z is disregarded. For example, the adjustment U (costs) amounting to NOK -71,559 in the 1993 management accounts (A) implies a 35% change in relation to the net operating income in the tax accounts (C). Special cases are thus years with only a small surplus or deficit and substantial adjustments. In such cases, the relative change would be quite large in relation to the adjustment measured in NOK.

Normally one would expect B (depreciable assets) to be negative, i.e., reducing balance (method of) depreciation is greater than straight-line depreciation. That will give an additional adjustment of the tax accounts to achieve management accounts. Nevertheless, the adjustments from 1993 to 1996 change from negative to positive. This could be due to more investments during the latter part of the period than in the first few years. The fact that the adjustment is negative when expressed in NOK, and positive when expressed as a percentage (e.g., in 1994: NOK -6,129 and +11.19%) can be explained by that the net operating income in the tax accounts (C), is negative.

In Table 11.4, which presents absolute values, it can be seen that the difference in U (costs) between tax accounts and management accounts amounts to for example 44% of the net operating income in the 1993 tax accounts (C). There is nothing peculiar about such large differences. In the tax accounts, costs include investments as well as the purchase of

Table 11.3 Adjustments between tax accounts and management accounts, see Figure 11.2. Deviation (in percent, +/-) relative to the net operating income in the tax accounts (C). Non-absolute values

Year	I	U	B	BR	REST
1993	7,728	-71,559	-3,782	-518	70,179
	0.02	-35.31	-2.08	-2.26	34.77
1994	21,440	-99,015	-6,129	34,048	68,966
	10.06	-77.48	11.19	38.96	23.38
1995	20,944	-82,952	12,212	2,086	65,944
	-4.18	-56.26	-1.27	-18.02	145.34
1996	21,885	-76,620	9,891	-1,323	60,946
	6.26	-21.62	-11.85	-14.70	44.38
Average a)	17,945	-82,488	3,054	8,608	66,511
	3.13	-47.46	-1.12	1.19	60.78

a) Average for all observations and all years.

Table 11.46 Adjustments between tax accounts and management accounts, see Figure 11.2. Deviation (in percent, +/-) relative to the net operating income in the tax accounts (C). Absolute values

Year	I	U	B	BR	REST
1993	39,289	89,425	40,181	47,975	86,933
	20.11	44.80	20.27	25.04	44.94
1994	36,905	112,680	46,366	56,436	86,249
	19.32	100.99	32.34	54.09	52.29
1995	40,660	91,826	39,065	30,714	75,523
	31.59	61.14	29.97	33.47	148.55
1996	37,417	85,827	39,678	36,440	68,362
	34.32	96.32	38.27	35.63	47.83
Average a)	38,540	94,942	41,314	43,044	79,307
	26.27	75.97	30.27	37.07	72.30

a) Average for all observations and all years.

equipment such as fertilisers and feed concentrates. In management accounts, on the other hand, there is a matching procedure related to the income activities, so that expenses actually are costs (accrual accounting). This means that one thus is comparing expenses with costs (i.e., expenses plus the inventory value changes. The problem is equivalent for I (income).

The adjustment Rest is the sum of net adjustments I, U, B and Br and private book entries in the tax accounts. The estimated house rent is included in the tax accounts, but not in the management accounts. Net rent including house maintenance is NOK 12,022 in 1996. Family labour investment is estimated and has an opposite effect because it is only included in the management accounts. In 1996, family labour investments amount to NOK 2,638.

The farm dwelling as an asset is a part of Br (other assets than B). In 1996, the changes in the asset value are NOK 5,466.

11.9 Discussion and conclusions

In this article we discuss the difference between tax accounting and management accounting, and attempt to quantify the resulting differences. In addition, the differences for certain categories in the accounts are presented.

As expected, the results are significantly different. In the present selection of farms, the difference for each farm is less when regarding the results over a period of several years than when considering each year by itself. This indicates that counselling based on the results of several years' tax accounts is better than using tax accounts from a single year.

The effects vary considerably from farm to farm. One of the reasons for this is that investments are entered differently in the two types of accounts. It seems as if the differences to a certain degree depend on the type of production. The average results are thus influenced by the type of farms making up the selection.

The study shows that in some years the management accounts result in higher income than the tax accounts, and in other years it can be opposite. In all years, the average results for dairy farms (regarded as full-time farms) were higher in the tax accounts than in the management accounts. On the part-time farms, the relationship between management accounts and tax accounts varied from year to year. The difference in NOK between the two types of accounts is significantly larger on the full-time farms than on the part-time farms, whereas the latter group has a larger relative difference.

The study shows that differences between various sub-categories in the accounts can be much larger than differences between the overall results (net operating income). This is due to differing practices regarding the division and organisation of data.

The choice of depreciation principle has no significant influence on the adjustment of tax accounts to management accounts. However, depreciation profiles can show substantial differences in years with large investments, when reducing balance depreciations are larger than straight-line depreciations. In this study, straight-line depreciations (management accounts) are larger than reducing balance depreciations until 1995.

The results are furthermore affected by the length and timing of the investigation. Valuation of benefits in kind (household consumption) in the tax accounts are especially influenced by forthcoming changes in tax legislation. In the year before this study commenced (1992), it was planned to omit the deductibility of farmhouse maintenance in the tax accounts. Due to this, a lot of farmhouse maintenance was probably carried out in 1992 and preceding years. This presumably led to a period of lower than usual maintenance costs during the course of this study. We have thus relatively modest figures for private maintenance in the item *Rest*.

The adjustment of sub-categories based on tax concerns to management accounts is difficult since the treatment of the changes of balance sheet values implies differences in two places. For example, *expenses* in tax accounts does not record the changes of balance sheet values, whereas management accounts do. This difference is then adjusted in the item *Rest*. The study has thus shown that the sub-categories in the accounts do not include the same information in the different accounting types.

Is management accounting a good enough analysis and planning tool? For example, should capital be treated differently in management accounts, or is the income assessment in forestry 'correct'? Another issue to be debated is when to recognise, e.g., the expected agricultural crop insurance. These questions, however, are not dealt with within the scope of this article.

Given that the principles of management accounting are better suited for analysis and planning than the principles of tax accounting, the study indicates that the use of management accounts can be considered a beneficial development of tax accounts.

Notes

1) Thanks to Agnar Hegrenes and Finn G. Andersen for useful comments throughout this study.

2) We can use 'Forestry profit' (average income for a 5-year period) from the tax return. In the further analysis we use the annual result as a measure for (taxable) profit in forestry.

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12. Census information on non-farm activities as a possible base for the agricultural holdings and possible application of the NACE Rev. 1. to agricultural surveys

Simo Tiainen [1]

Abstract

The Community agricultural census 1999/2000 will collect some new information on holdings' non-farm activities. This paper considers the possibilities to use this information as a base for classifying the agricultural holdings. Beside the current Community typology, new classifications schemes could be used for improving the sampling, analysing and presentation of the results of agricultural surveys. The paper also sheds some light on the possibility of using the NACE Rev.1 as a base for classifying the agricultural surveys.

Key words: agricultural census, classification, FADN, NACE Rev. 1, non-farm activities, typology

12.1 Introduction

The Community Farm Structure Surveys (FSS) form an important data source for planning and assessing the effects of Common Agricultural Policy. The Council Regulation 571/88 (as amended by Regulation 2467/96) stipulates that the Member States of the EU will carry out a full agricultural census in 1999 or in 2000. The list of characteristics to be surveyed in this census was fixed separately by Commission Decision 98/377. In order to better fulfil new information requirements arising especially from the part on rural development of the new CAP, some new information on holdings' non-farming activities will be collected in this census.

This paper considers the possibility of using this information on non-farming activities as a base for the classification of holdings. New classifications schemes could be used e.g. for improving the sampling of agricultural surveys. They could also give new means for analysing and presenting the survey data and for improving the weighting of sample surveys. The final part of the paper considers the possibility of using the statistical classification of economic activities in the European Community - the NACE Rev.1 - as a base for classifying the agricultural surveys.

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12.2 FSS and FADN

There is a close link between the main micro-level Community agricultural surveys; the Farm Structure Surveys (FSS) carried out by Eurostat and the Farm Accountancy data Network (FADN) carried out by the Agriculture Directorate. The following connections between the surveys could be distinguished:

I. when the Member States compile their FADN selection plans, the FSS provides the farm population. After fixing the survey threshold for FADN, the FSS provides the field of observation for it;

II. the farm registers in Member States are (normally) updated on the basis of the farm structure surveys. The FADN use the farm register for picking the list of farms to be recruited to the survey and for handling the non-response of farmers;

III. at the Community level the FSS forms the base for the FADN weighting system. The FADN is a sample survey from the population which is known currently only via Community FSS. To be able to extrapolate the FADN results to represent all (commercial) holdings in the Union, the holdings in the sample (FADN) and in the population (FSS) have to be classified according to the same criteria. Currently the Community typology for agricultural holdings is the base for this common classification between the surveys.

12.2.1 The Community typology - the current classification scheme

As previously mentioned the Community typology for agricultural holdings is the base for classifying the holdings both in the FADN and in the FSS. The typology is used both at the Member States and Community level. In the Member States the typology is used for defining the samples for Community agricultural surveys (FADN selection plan, FSS samples). It is also often used for presenting the national survey results. At the Community level the typology is used in the FADN weighting system and is also used for presenting both the FADN and the FSS results.

The typology is based to Community legislation (Commission Decision No 377/85 + amendments 376/94 and 393/96). The legislation lays down the rules on how to classify the holdings according to their *type of farming* and their *economic size*. The classification is based on *standard gross margins* (SGM) determined by the Member States for different agricultural enterprises (= survey characteristic on land use and livestock). The farm classification in typology is based only on the holdings' agricultural activities. The non-farm activities of holdings do not have any influence on the classification.

The Community typology is currently very intimately bound up with existing systems, at Member States and Community level. Thus all modifications to it would be very difficult. Hence, when considering the new classification schemes, the right approach should be to develop alternative classifications alongside the existing typology and not to modify or replace the current typology (at least in the short term). Correspondingly the current technique-economical classification scheme must not exclude these alternative new classifications.

12.2.2 The survey unit

The definition of the survey unit is naturally a very relevant question when considering the classifications. The agricultural holding is the basic survey unit for both the FADN and for FSS. Currently the agricultural holding is currently defined as follows [1]:

I. a single unit both technically and economically, which has single management and which produces agricultural products. Other supplementary (non-agricultural) products and services may also be provided by the holding;

II. 1. an agricultural holding is thus defined by the following characteristics:
   - 1.1 Production of agricultural products
     For the purpose of FSS 'agricultural products' are defined in separate annex [2];
   - 1.2 single management
     There can be single management even though this is carried out by two or more persons acting jointly;
   - 1.3 a single unit technically and economically
     In general this is indicated by a common use of labour and means of production (machinery, buildings or land, etc.).

The agricultural census should thus cover all units producing agricultural products with the exception - of course - of the units under the survey threshold (normally one hectare or one ESU). As can be seen, the non-farm activities carried out in the holdings do not influence the definition.

12.3 Information on non-farm activities in the 1999/2000 census and the possibilities to use it in the classification

Forestry

Farm forestry is doubtless the most important non-farm activity carried out in agricultural holdings in several Member States. Annex 1 highlights the importance of farm forestry in the EU. In the agricultural census 1999/2000 the following information on forestry will be collected:

H02	Wooded area	ha
(f)	managed mainly for selling the wood produced	ha
(g)	Does the holding have wooded areas with short rotation (15 years or less), for example for: Christmas trees, energy production (e.g. Salix), pulpwood	ha

[1] The definition of agricultural holding is laid down in Eurostat document CPSA 322 of 22 February 1999). This Draft Commission document was approved by the Standing Committee of Agricultural Statistics on February 1999 and it will become into force as a Commission Decision later this year.

[2] The list of agricultural products has been drawn up on the basis of the NACE Rev. 1, the CPA and the Harmonised System. The list of products is in most parts identical to the one used in Economic Accounts of Agriculture.

production (e.g. poplars, eucalyptus)?

The heading H02 will be collected from every Member State, but subheading (f) and (g) are optional for every Member State.

As mentioned before, the farm forestry carried out in agricultural holdings is not taken into account in the Community typology. Instead several Member States (Germany, Austria, Italy, Sweden) include (or have means to include) the forestry as a part of their national agricultural typologies.

At the EU level the information on forestry collected in Community FSS could be used as an additional information to present typology as follows:

- the SGM for wooded areas (for characteristics H02) should be defined for different regions;
- holdings' total forestry SGM will be calculated in a parallel way as in the Community typology → the scale of wooded area (number of hectares recorded in H02) is multiplied by appropriate forestry SGM.
- total forestry SGM is compared to the total (agricultural) SGM. The relative importance of forestry could be presented e.g. in the following way:

Class	Definition
A. Forestry holdings (Holdings where forestry is the major activity)	Forestry SGM > 50% of total SGM (TSGM) of the holding
B. Holdings where forestry is important	1/2 TSGM ≥ Forestry SGM > 1/3 TSGM
C. Holdings with some forestry activities	1/3 TSGM ≥ Forestry SGM > 1/10 TSGM
D. Holdings with minor forestry activities	Forestry SGM ≤ 1/10 TSGM
E. Holdings without forestry	Forestry SGM = 0

Labour force

The part labour force questions in the next census include the following questions on other gainful activities.

L07 Does the sole holder who is also the manager or do the partners of a group holding have any other gainful activities? If 'yes' how many of the holders have other gainful activities:

- as his/her major occupation?	Number of
- as a subsidiary occupation?	holders/partners

L08 Does the sole holder's spouse, carrying out farm work for the holding, have any other gainful activity:

- as his/her major occupation?	yes/no
- as a subsidiary occupation?	yes/no

L09 Does any other member of the sole holder's family engaged in the farm work of the holding have any other gainful activity? If 'yes', how many have other gainful activities:

- as his/her major occupation? — Number of persons
- as a subsidiary occupation?

Labour input has traditional been an also classification criteria for agricultural holdings in some countries. At first sight the information obtained from characteristics L07, L08 and L09 could be used to make a distinction between the farmers who have other gainful activities as a major occupation, as a subsidiary occupation or who do not have other gainful activities. However, the problem is that the definition of 'other gainful activities' here does not make distinction on where the activity takes place. Other gainful activity here is defined as follows:

I. Every activity other than activity relating to farm work, carried out for remuneration (salary, wages, profits or other payments, including payment in kind, according to the service rendered)

II Includes gainful activities carried out on the holding itself (camping sites, accommodation for tourist, etc.) or on another agricultural holding as well as activity in a non-agricultural enterprise.

When planning the new classification of holdings (the survey units), the information on labour input used for other gainful activities carried out on the holdings itself would be essential. This information would give means to evaluate the importance of different activities taking place on holdings and would give also means for new classifications. This is an issue to be added to the 'shopping list' for future FSS [1].

Rural development

In the list of characteristics for the 1999/2000 census questions related to the rural development are completely new in the Community FSS. On that subject the following questions were possible to be included to the census.

M01 Other gainful activities on the holding (other than agriculture), directly related to the holding

(a)	tourism, accommodation and other leisure activities	yes/no
(b)	handicraft	yes/no
(c)	processing of farm products	yes/no
(d)	wood processing (e.g. sawing, etc.)	yes/no
(e)	aqua culture	yes/no
(f)	renewable energy production (wind energy, strawburning, etc.)	yes/no
(g)	contractual work (using equipment of the holding)	yes/no
(h)	other	yes/no

[1] The next FSS in the EU after the 1999/2000 census will take place in 2003. The decision on the list of characteristics for that survey will be done in 2001.

Subheadings (a) - (h) are optional for several Member States

The new information collected on other gainful activities carried out on holdings is certainly very welcome to highlight these important phenomena. However, since there will be no information on the scale of these non-farm activities, the use of this information as a basis for holdings' classification will be rather limited. In future FSS there should be some criteria for assessing the scale of these activities. The difficulty will be to find the simple and pragmatic criteria to obtain a good approximation. The possible criteria could be e.g. gross output, labour input used or measurement of the physical size of activity (and afterwards using 'standard gross margins' for them).

One possible way of using this new information on rural development could be to compare it with the information on labour input on other gainful activities (recorded in characteristics L07-L09). If other gainful activities are carried out on the holding (section M), the labour input information (section L) could be used to get a picture of the importance of this activity (assuming that the work takes place on the holding).

Possibilities to use the NACE Rev.1 in agricultural surveys

The Council Regulation (No 3037/90) on the statistical classification of economic activities in the European Community (NACE Rev.1) [1] started a long discussion (still going on) in Eurostat's 'experts on typology of agricultural holdings' working group of the impact of NACE Rev. 1 to agricultural surveys. The Regulation seems to require the use of NACE Rev. 1 both by Eurostat's and Member States' agricultural statisticians. It also requires that the statistics collected after 1 January 1993 by Member States involving classification by economic activity, shall be compiled using NACE Rev. 1 or a national classification derived therefrom.

The NACE Rev. 1 classifies section A, where agriculture is included as in Table 12.1.

As can be seen, the agricultural census and the FADN are limited to groups 01.1, 01.2 and 01.3 of the NACE rev. 1. The coverage could not be increased to division 01 or the whole section A of the NACE, without radical change of the survey unit definition. If there would be a need to increase the coverage of the agricultural census e.g. over the whole of division 01, the census should then cover the units dealing also with agricultural services, hunting, trapping etc. This kind of development could not be considered to be very realistic.

In the NACE Rev. 1 each statistical unit is classified on the basis of the activities it carries out. The class of the unit is determined by its principal activity: the one that contributes most to the gross value added at factor cost (or another appropriate criteria e.g. gross output, value of sales, labour input etc.) of the unit. If one activity accounts for more than 50% of value added, this determines the classification of the unit [2].

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[1] The acronym 'NACE' derives from the French title: Nomenclature généralé des activités économiques dans les Communautés Européennes.

[2] In all other cases the 'top down' method is applied for classification. The detailed description of classification rules is presented in the Eurostat publication NACE Rev. 1 Statistical Classification of economic Activities in the European Community, Luxembourg 1996, ISBN 92-826-8767-8.

Table 12.1 Classification of agriculture in NACE rev. 1

Section A			Agriculture, hunting and forestry	
Division	Group	Class	Description	ISIC Rev. 3
01			Agriculture, hunting and related service activities	
	01.1		Growing of crops; market gardening; horticulture	011
		01.11	Growing of cereals and other crops n.e.c.	0111
		01.12	Growing of vegetables, horticultural specialities and nursery products	0112
		01.13	Growing of fruit, nuts, beverage and spice crops	0113
	01.2		Farming of animals	012
		01.21	Farming of cattle, dairy farming	0121x
		01.22	Farming of sheep, goats, horses, asses, mules and hinnies	0121x
		01.23	Farming of swine	0122x
		01.24	Farming of poultry	0122x
		01.25	Other farming of animals	0122x
	01.3		Growing of crops combined with farming of animals (mixed farming)	013
		01.30	Growing of crops combined with farming of animals (mixed farming)	0130
	01.4		Agricultural and animal husbandry service activities, except veterinary activities	014
		01.41	Agricultural service activities	0140x
		01.42	Animal husbandry service activities, except veterinary activities	0140x
	01.5		Hunting, trapping and game propagation, including related service activities	015
		01.50	Hunting, trapping and game propagation, including related service activities	0150
02			Forestry, logging and related service activities	
	02.0		Forestry, logging and related service activities	020
		02.01	Forestry and logging	0200x
		02.02	Forestry and logging related service activities	0200x

If the NACE approach would be applied to agricultural surveys (assuming that the information on all activities is available), it would mean that those holdings having non-farm activities (e.g. processing of farm products -making juice from carrots) exceeding 50% of their total gross value added (or of another appropriate criteria) would be classified to classes outside agriculture (e.g. class 15.32 manufacture of fruit and vegetable juice).

The first three groups of NACE, 01.1 growing of crops, 01.2 farming of animals and 01.3 mixed farming, covers in principle those activities, which are covered by the agricultural surveys. A question could be raised, whether the NACE breakdown for groups and to classes could be used in a point of view of agricultural surveys? Currently the classification in the Community typology is much more detailed.

12.4 Conclusions

The information collected on holdings' non-farm activities in the 1999/2000 Community agricultural census would not give lot of means to develop new classification schemes for agricultural holdings. Inclusion of farm forestry as additional information to current typology could be the most desirable idea to go forward. The part of the questionnaire concerning the rural development is missing the information on the scale of the other gainful activities. The labour input part of the questionnaire on other gainful activities does not make the necessary distinction on where the activity takes place. When planning the list of characteristics for future FSS the decisions on data-content and classification of holdings should be more closely linked.

Applying the NACE Rev. 1 to Community agricultural surveys is not only a question of farm classification. To be able to apply completely the NACE Rev. 1, radical changes to the surveys should be done. The definition of a survey unit should be altered and the sufficient information on holdings' other activities should be collected. In the short term this is not foreseeable.

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13. Need for accounting data in managerial decision making process

Bo Öhlmér [1]

Abstract

Farmers are not using accounting data, despite that the data are available. In this paper I discuss why, and how the accounting data could be made more useful to the farmers.

The managerial decision making process is analysed, and relevant information areas are identified. The roles of accounting data, which information farmers do use in these areas and why they are not using accounting data are discussed. The analysis is based on a literature review.

Accounting data would be more useful if the accounting system could support a feed forward and compensating approach and produce forecasts. The accounting system should produce qualitative conclusions on future changes from previous conditions, in addition to quantitative reports. The forecasts should be a basis for producing comparisons with similar farms, and the comparisons should be available at once through internet or similar.

Keywords: accounting data, decision making, behaviour, information demand.

13.1 Introduction

Farmers produce accounting data mainly because it is stipulated by law. Despite that the data are available, many studies have shown that only a few farmers are using them in their managerial decision making or problem solving (Kuhlmann, 1999; Öhlmér, Olson and Brehmer, 1998; Ehrengren, 1999; Wålstedt 1996 among others). Why? Could accounting data become more useful for farmers?

The questions are answered by analysing:

- relevant information areas; i.e., the need aspect;
- which information accounting data could provide, i.e. the supply aspect;
- which information the farmers do use, i.e., the demand aspect;
- why farmers do not use accounting data, i.e., explaining the difference between supply and demand;
- if accounting data could be more useful and conclusions on what to do.

The analysis is based on a literature review.

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13.2 Relevant information areas

The Interstate Managerial Study by Johnson et al. (1961) is one of the few studies of how farmers make decisions. Most research and teaching have been in how farmers should make decisions. Orasanu and Connolly (1993) claim that most research on decision making has focused on the decision event, not the process. Johnson (1987) argues that the concept of expected utility has been emphasised to the neglect of other aspects of optimisation, such as problem definition, learning, analysis, other decision making rules, etc.

Orasanu and Connolly assert that little of the traditional decision making research can be applied to real-world decision making because of its emphasis on the decision event. While the decision event is critical to good decisions, it is limited in scope. Focusing on the event requires (1) assuming the decision maker knows his or her goals, purposes, or values; (2) that they are clear and stable over time; and (3) the decision maker faces a fixed set of alternatives for which the consequences (including risks) of each alternative are known. This need for simplifying and assuming is part of what Levins (1992) argues against. When compared with decision event models, the full decision model also includes: assessment of the situation, context, and nature of the problem; sequential evaluation of single options rather than a range of options; evaluation done through mental simulation of outcomes; and options accepted if they are found satisfactory rather than optimal (Orasanu and Connolly). Dynamic, real-time decision making is more accurately described as 'a matter of directing and maintaining the continuous flow of behaviour toward some set of goals rather than as a set of discrete episodes involving choice dilemmas' (Brehmer, 1990, p. 26)

Normatively-trained, farm management students usually exhibit a strong tendency to think of the decision process as a series of linear steps. Johnson et al. (1961) identify six steps of decision making: problem definition, observation, analysis, decision, action and responsibility bearing. A standard section in most farm management texts (which cover four decades) is a list of five to eight decision making steps (Bradford and Johnson, 1953; Castle et al., 1972; Boehlje and Eidman, 1984, Castle et al., 1987; Kay and Edwards, 1994). Steps listed in the texts but not listed explicitly by Johnson et al. include setting goals, monitoring, and evaluating results. Simon (1965) describes the decision process as a trichotomy: intelligence, design, and choice. Mintzberg et al. initially describe a similar trichotomy; identification, development, and selection and then develop a list of 12 routines within the strategic decision process: decision recognition, diagnosis, search, design, screen, evaluation-choice, authorisation, decision control, decision communication, and political. The farm management texts either state explicitly, or seem to imply, that the steps should be followed in a linear order for every decision, but researchers have found that decision makers do not follow the process linearly. Witte (1972) found that the phases of problem recognition, information gathering, development and evaluation of alternatives and choice were not followed linearly by either his whole sample of data processing equipment decisions or even the subsample of what he called the most efficient decisions. Nor were the phases followed in the smaller subdecisions that Witte found within the entire decision. Mintzberg et al. describe decision making as a 'groping, cyclical process' (p. 265). They did not find a linear process, nor did all of their studied decisions include every one of the 12 basic routines. They identify six factors that can create havoc with any idea of a straight, simple decision process: interrupt, scheduling delays, timing delays and speedups, feedback delays, comprehension cycles, and failure recycles. Johnson (1976, 1986, 1994) also notes these loops and nonsequential decision making process.

Based on the research just cited, farmers should obviously not be expected to follow a common set of steps in any simple, sequential process, However, perhaps because we too are faced with limited human processing capability, we find it useful to identify the separate functions (but not steps) of decision making.

Following Öhlmér, Olson and Brehmer (1998), we distinguish four functions or phases (Figure 13.1):

- problem detection, resulting in detection of a problem or not;
- problem definition, resulting in choice of options for further development;
- analysis and choice, resulting in choice of one or more options;
- implementation, resulting in output consequences and responsibility bearing.

Phases	Subprocess			
	searching and attention	planning	evaluating and choosing	bearing responsibility
Problem detection	Information scanning; paying attention		Consequence evaluation; problem?	Checking the choice
Problem definition	Information search; finding options		Consequence evaluation; choice of option to study	Checking the choice
Analysis & choice	Information search	Planning	Consequence evaluation; choice of option	Checking the choice
Implementation or action	Information search; Clues to outcomes		Consequence evaluation; choice of corrective action(s)	Bearing responsibility for final outcome; feed forward information

Figure 13.1 Conceptual model of the decision making process (Öhlmér et al., 1998)

Each phase consists of three to four subprocesses:

- searching information and paying attention to relevant information;
- planning, which was included only in the phase of analysis and choice of option;
- evaluating consequences and choosing alternative;
- bearing responsibility of the choice.

The problem detection and problem definition phases have been modelled quantitatively in a recursive equation system using the LISREL method and data collected with a questionnaire sent to a random sample of farmers (Öhlmér et al., 1997 and Öhlmér, 1998). The $\chi 2$ -value of the submodels, and the t-values of the parameters showed that our conceptualisation of problem detection and problem definition provides a reasonable explanation of this part of the decision process.

This means that a farmer needs information for:

- detecting problems;
- finding causes to problems and options to solve them;
- analysing and choosing options;
- forecasting the performance in a feed forward and compensation approach during implementation or action.

Next section will be structured in these information areas.

13.3 Which information could accounting data provide?

13.3.1 Detecting problems

In detecting problems a farmer compares his observations to his expectations. He pays attention to differences, forms an opinion about consequences of the differences, evaluates the consequences and chooses whether he has a problem. Examples are that he can compare his accounting data to (1) budget, (2) previous years, or (3) similar farms, where accounting data are the observations, and 1, 2 and 3 are used to form his expectations. The accounting data could be transformed to key indicators, such as solidity, rentability, etc., before the comparison to expectations. This is a part of the alarm aspect discussed in literature on key indicators (Mossberg, 1977; Ånebrink, 1985).

13.3.2 Finding causes and options

In finding causes and options, a farmer searches for and analyses the cause(s) of the problem, searches for options to solve it, and does an initial evaluation of the options. The options are evaluated in general, affective terms (i.e. like or dislike; Van Raaij, 1988) or in terms of compatibility with the decision maker's morals, values, beliefs and implications for existing goals (Beach, 1993).

Finding causes is the diagnose aspect discussed in literature on key indicators (Mossberg, 1977; Ånebrink 1985). The causes could give some indications for the search of options. Accounting data, or economic key indicators, could be analysed in economic models to find the causes. Examples are financial analysis, the du Pont model, and the lever formula (Asztely, 1981; Hallgren, 1977).

13.3.3 Analysing and choosing options

In planning an option, textbooks recommend the manager to use investment analysis methods, budgeting methods, organisation planning methods, etc. These methods are mostly based on forecasts of incomes and costs, and profit (or utility) maximisation. Accounting data are used in forecasting the incomes and costs. This is the planning aspect discussed in literature on key indicators (Mossberg, 1977; Ånebrink, 1985).

According to theories of bounded rationality (Simon, 1957; March and Simon 1958; Simon, 1986) or the behavioural theory of the firm (Cyert and March, 1963), managers analyse only a few options in an approach of satisficing aspiration levels. Lipshitz (1993) has studied decision making in realistic settings, and found that none of the studied models used calculative cognitive processes for choosing options. The different cognitive processes, which were used, related to creating images of the situation: categorisation, use of knowledge structures, and construction of scenarios. Several options may be identified, ranked by preferences and evaluated one at a time until a satisfactory one is found (Calderwood et al., 1987; Klein, 1989; Klein et al., 1986). Forecasts on incomes and costs based on accounting data, or the accountant's comments, may be a part in creating the images.

13.3.4 Forecasting performance during implementation

Öhlmér et al. (1998) have found that during implementation, farmers continually checked the performance of the implemented actions. This control process began as soon as information was available - when the information was still only clues. The expectations about the outcome of the action were adjusted and became more accurate as the implementation proceeded, for example, the estimated cost of a new building. At the end of the implementation the managers usually perceived their outcome expectations to be so accurate that their interest in an ex post calculation and accounting was low. Accounting data may be used in the control process, such as in comparing actual performance to budget. This is a part of the alarm aspect discussed in literature on key indicators (Mossberg, 1977; Ånebrink, 1985).

Information from implementation could result in changes in the expectations of the action. If the cause of this change in expectation was perceived to be random, only the plans of the continued action were updated. If the cause was perceived to be nonrandom, the rules of thumb or planning methods (including information search rules) used to form the expectations were updated also. This is the building experiences aspect discussed in literature on key indicators (Mossberg, 1977; Ånebrink, 1985).

13.4 Which information do farmers use?

In the introduction it was stated that only a few farmers are using accounting data in their managerial decision making. Two explanations have been found in the literature:

- some farmers are using production data instead of accounting data;
- many farmers use intuitive decision making instead of analytic.

When using production data instead of accounting data for problem detection and monitoring purposes, the farmer will detect a problem or a need of corrective action earlier. As a consequence, farmers are using services in production analysis to some extent (Ehrengren, 1999).

Many farmers use intuitive decision making instead of analytic, as was found by Lipshitz (1993). Öhlmér et al. (1997) studied farmers' strategic decision making and found that there were twice as many farmers using an intuitive approach as an analytic. Farmers formed the expectations and estimated consequences as directions from current conditions and crude quantitative categories such as 'small' or 'large' change. If the price will go down, they know from, e.g. experience, that the farm income will go down. Farmers preferred a 'quick and simple' approach over a detailed, elaborated approach. They preferred to collect information and avoid risk through small tests and incremental implementation. In such a decision process, accounting data are not used.

Current conditions were well known, and the farmers did not need so much new information to perceive the changes, plans and consequences as directions related to current conditions. The farmers could keep their problem perceptions, ideas of options, plans and expectations in their head, which made it easy and quick to update them when new information was obtained. Sörlie (1982) has found that also managers of other small businesses manage their firms without pen and paper.

In such a decision process, accounting data are not used, at least not directly. The accountant may transform the accounting data to changes from current (or previous) conditions as directions and crude quantitative categories. However, managers prefer a feed forward and compensation approach, so they look for changes in the production processes as well as in the market and other aspects of the environment before the changes could be observed in accounting data. They are not willing to wait until the changes have had an effect on the payments and, thus, could be observed in accounting data.

13.5 Could accounting data be of more use?

Accounting data have to support the feed forward and compensating approach to be more useful for farmers. Integrating the accounting system with early indicators from automated data collection in the production (e.g. in feeding equipment and milking robots) and from the environment to produce forecasts may be a solution. The forecasts should support evaluation of small tests and incremental implementation of actions. I addition to supporting the feed forward and compensation approach, the accounting system should be able to produce both simple qualitative conclusions about changes from previous conditions and quantitative reports.

It should be good if the forecasts could be used as a basis for producing comparisons with similar farms. The comparisons should be available at once for the individual farmer, which would be possible through internet. The conclusions could be both qualitative and quantitative.

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14. Software for the Dutch FADN as a tool for micro-economic research [1]

Krijn J. Poppe

The problem

The Dutch Agricultural Economics Research Institute's FADN gathers data on 1,500 farms. It is the most important data source for the micro-economic research in the institute. The software of the FADN is currently renewed. The trigger for this innovation was mainly spaghetti-software: in the eighties and early nineties much software was added to the accounting software, especially to collect environmental data. Researchers use a separate database (with other code systems) than data collectors, as they work with long term trends and integrate the FADN data with those of the Farm Structure Survey. All this resulted in inflexible software with high maintenance costs.

A survey of stakeholders learned that they have several new demands. More emphasis is given on sector data in stead of farm type data, which makes an integration of the separate FADNs for horticulture and agriculture necessary. There is a need for even more physical data (minerals, pesticides, pharmaceuticals for animals, nature conservation). Data should be more actual than historic, by providing quarterly data and organising ad hoc questionnaires in the panel. Policy makers also indicate that more competition for the FADN arises, as more databases become available (subsidies from the IACS - the Integrated Agricultural Control System, commercial accounting offices). Policy makers also find it hard to predict future policy research questions. Although this is partly more a feeling than a true description (one can track that the sugar policy is up for revision in e.g. 2001), it turns out that they are willing to pay for a flexible tool - where flexibility is the enemy of efficiency. This implies a constantly changing data model.

Based on this review of the situation in a feasibility project, it was decided by the Dutch Ministry of Agriculture and the Agricultural Economics Research Institute to design a new strategy for the FADN: it changes into a Farm Information Network that is able to collect on a quarterly basis much more data than only accounting data. This will be based on new working methods and up to date use of ICT. Under project management of the institute, but with the help of outside consultants and an investment of nearly EUR 3.5 million, a project to change the system has been started.

[1] This paper is an adopted version of a part of the paper 'How recent developments in ICT support policy analysis and farm accounting'. In: G. Schieter et al.

The solution

The information strategy, designed in the feasibility study, proposes to organise the FADN in a client oriented way, using a management contract and a Balanced Score Card as a service level agreement. That makes (and keeps) the FADN organisation more market oriented in a situation where the research institute is turned into an agency on output-finance. In addition the FADN will be ISO-9000 certified.

The FADN can be split up in four business areas, for which software and new procedures are developed (Figure 14.1). Data gathering and data recording have been identified separately, due to the growing importance of electronic data gathering. Regarding the ICT, it was proposed to decentralise software as much as possible and to use EDI (available and already used in the old system) to provide data on a monthly or at least quarterly basis. A big improvement, using cheap data storage and processing capacity, will be that items will not be aggregated anymore. In the old system all individual payment and invoice data of the farmers were aggregated (in a general ledger) to a yearly data item. That leads to an enormous loss of information value, due to aggregation and to delays. Delays on e.g. data for energy use in winter time in glasshouse horticulture or on the use of pesticides in spring time in arable farming, are at the moment easily more than one and a half year - too much for the users.

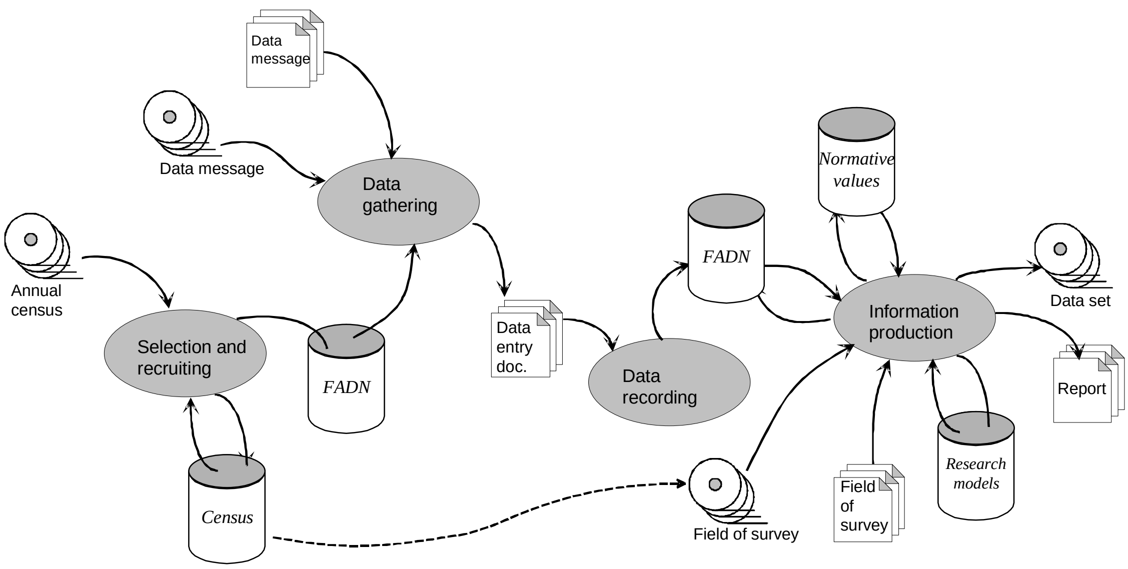


Figure 14.1 Information structure

Aggregation often does not only mean that two transactions of the same kind (e.g. buying of nitrogen) are added, but also transactions with different data definitions (e.g. nitrogen and potassium into fertiliser). This aggregation is especially a pity for many researchers. The FADN is not able to standardise its users: e.g. the EU-FADN uses other definitions as national accounts or the Dutch Environmental Planning Agency on e.g. investments. This hampers re-use of expensive data. Regarding the definitions of certain concepts there does not seem to be an objective truth. ICT provides solutions to this issue.

The data model for the collection of the data is as much 'concept free' as possible, by recording the data in the form they are observed without any interpretation or aggregation. Calculation rules in the database than provide derived data according the different concepts used by the researchers. It is clear that this asks for a stronger central data management, to promote re-use of data and models. This helps to support the desired flexibility.

The need for flexibility has further been solved by abandoning the general ledger approach in the FADN. In stead about 16 reference tables have been defined (e.g. type of products, type of labour, type of machine, type of service, official regulation) that can be used to classify a transaction, payment or inventory to the classification that is at that time relevant for the Agricultural Economic Research Institute. These tables can be updated by the data managers with a stroke of the key. This means that the new system will be constantly changing, assuming that information needs in micro-economic research change.

This flexibility means that a lot of documentation has to be stored in the system, as some users are interested in trend analysis, and have to know which data definitions have been used in the past. Therefor it was decided to make two tools to support the constantly changing system:

- data dictionary with constantly changing data items and documentation (meta data);
- screen-generator for constantly changing data entry methods (new data items, EDI) with their instructions.

Quality management is not only related to software quality. The system changes constantly and the key for quality lies in the processes that adapt the system. These will be ISO-9001 certified. The data model of the central database contains entity types like procedure, act, instruction, task, software component, authorisation, data value, entity, notion, aspect, and relationship (Figure 14.2). This looks like a mixture of a workbench and a workflow management tool, and in a certain sense it is.

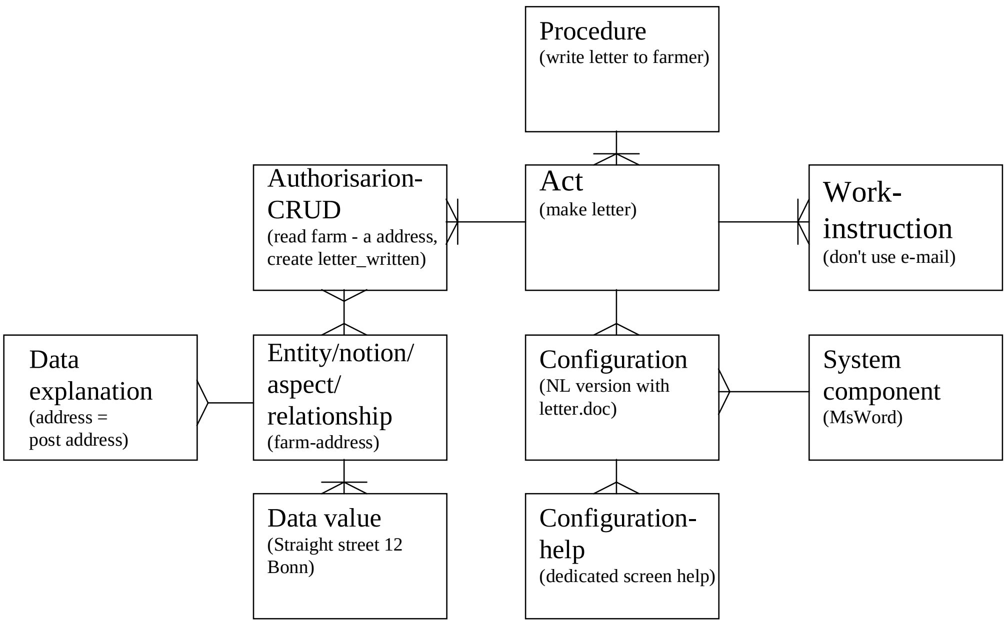


Figure 14.2   Data model ARTIS (simplified, example between brackets)

The data that must be gathered in the FADN and the conditions on which they are relevant, correct and actual are described in a this abstract model in the database ARTIS (Agricultural-economics Research Tool with Information-induced Software). The procedures for data gathering (the accounting information system) and the corresponding instructions are also described in the database. The same is true for the configurations of data-entry screens and formats of electronic data messages.

When a data collector has to gather data, he starts a procedure by selecting one from the to-do-list on his screen. If one of the acts of a procedure requires software, it is started automatically and corresponding instructions are available on-line in the Internet browser. The screen shows then the data entry fields that are relevant (Figure 14.3).

This concept led to a choice for Object Oriented (OO) programming and an OO database (Gemstone database, Smalltalk with Visual works for programming). Such an OO database can also store sound and video and can support different formats like HTML, GIS-formats etc. Data entry directly will be done directly on the database (one network with ISDN lines or GSM portables to 16 regional offices where thin clients are used that feed the central server).

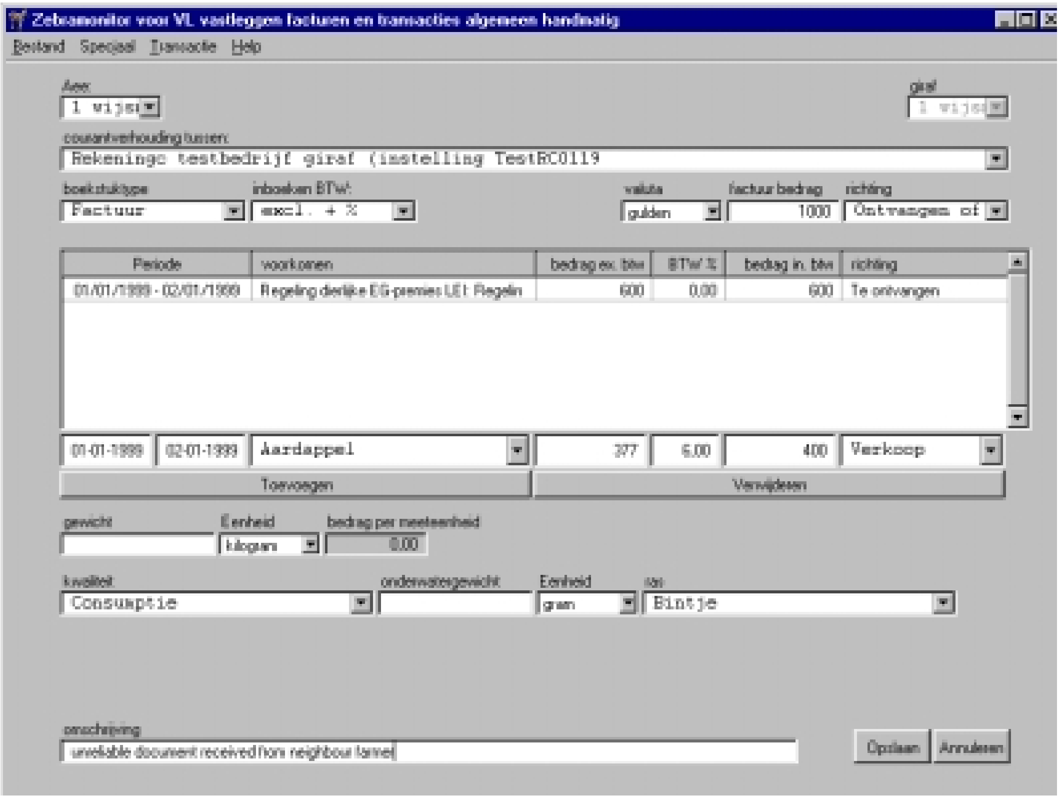
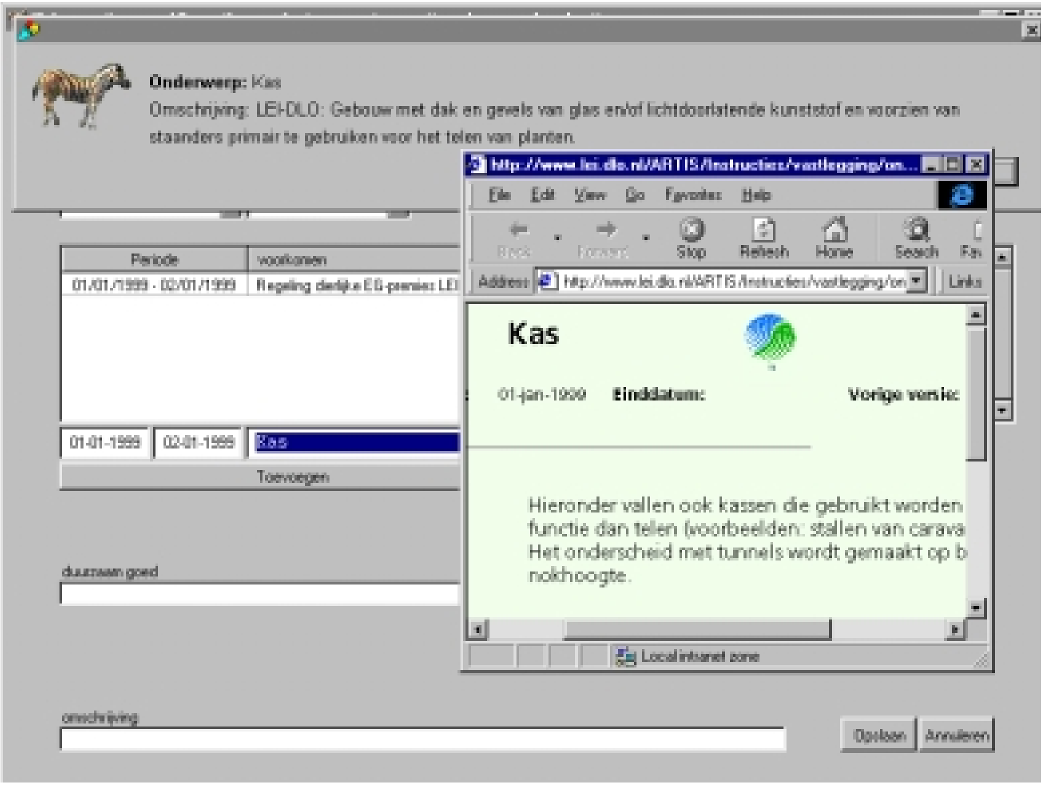


Figure 14.3 Demo ARTIS screens in Accounting 2000



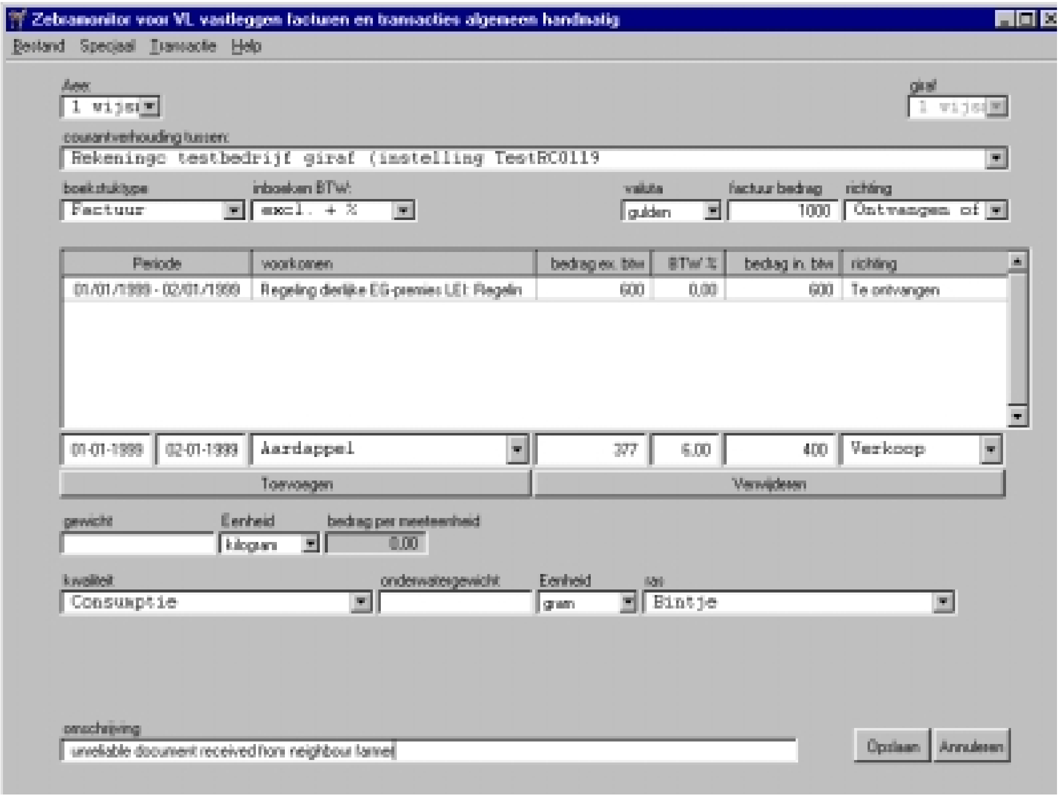


Figure 14.3 Continue

Conclusions

The case of the Dutch FADN learns that a total re-engineering of the FADN in connection to the introduction of up to date ICT can lead to a very useful micro economic database. By using EDI labour costs can be reduced and new types of data can be gathered. By recording the data as free from interpretation as possible, a large variety of researchers has possibilities to manipulate the data according their own concepts. Documentation of data is improved. By making use of cheap data storage, much more data becomes available for economic research.

The Dutch case shows that re-engineering and good data management to exploit the possibilities of ICT can have a large contribution to better micro economic policy analysis and farm accounting. It can also lead to better farm management (precision farming, improved performance, chain management, providing product information to the consumer).

To realise those benefits it seems necessary to look as a user with an open mind to recent developments in ICT. The courage to question current working methods and the understanding that they need to be re-engineered to exploit the full benefits of up to date ICT is essential. This brings uncertainties that can be reduced by exchanging ideas and experiences. In farm accounting and micro-economic research the PACIOLI group could play this role. For the future the LEI and its partners in creating the software intend to make the software available for free (like the Linux concept) to foster further innovation.

15. The Belgian FADN as a data source for environmental indication

Dirk van Lierde, Nicole Taragola [1]

Abstract

This paper examines in which way the Belgian FADN can be an instrument for environmental indication. Also is examined to what extent the Belgian FADN attained its goal presented in PACIOLI 3 of developing an integrated software to collect accountancy and environmental data. Currently data on nutrients, pesticides and energy are collected in the FADN. The consumption of fertiliser is known per crop. Recently the flows of manure between farms and the use of manure per crop are recorded. Reliable data on the nutrient contents of feed are still lacking to draw up a nutrient balance. From this accountancy year on the use of pesticides is recorded for a number of crops and the energy consumption and the efficiency of energy used in horticulture is analysed. Although this seems very positive the aim proposed in PACIOLI 3 was not achieved. The data are not collected in an integrated flexible software. For a lot of reasons it was preferred to develop separate software for the different applications. In the long run there are less possibilities for data collection and there is a risk that one day all these separate software will collapse. Time will tell if this choice was the right one.

15.1 Introduction

In agricultural policy more en more attention is focused on environmental items. In Agenda 2000 an important role is reserved for environmental measures, on the one hand to support sustainable development of the country side and on the other hand to meet the wishes of the society for more concern for the environment (European Community, 1997). People become more and more aware of the importance of the environment. However human activities go along with important emissions to the environment. It is not surprising that the authorities want to measure the importance of the emissions of different activities. These emissions originate from industry, agriculture and the activities of private persons. The emissions of the agricultural sector are mainly related to minerals, pesticides and energy. In order to measure the emissions of the agricultural sector we need data on the use of raw materials contributing to these emissions. The FADN can become an important source of data on the use of these raw materials. In a traditional financial accountancy only

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financial data are presented. However with a limited adaptation of the system also the amount of raw materials used can be registered, which can serve as a basis for calculation of environmental indicators. In most FADN's great efforts are done to adapt the accountancy system in order to deliver the maximum of information on environmental issues. In previous PACIOLI workshops the subject was treated at length (Poppe, 1996; San Juan, 1996). In PACIOLI 4 a project proposal was presented 'Recording environmental impact' that was intended to monitor mineral balances, energy balances and efficiency, use of pesticides, and so on (Beers et al., 1997).

The Belgian FADN was also partly adapted to these new requirements. In PACIOLI 3 a paper focusing on these new developments was presented (Van Lierde and Taragola, 1996). Now three years later a summary of the realisations and shortcomings in the area of environmental indicators in the Belgian FADN can be presented. Special attention will be given to the use of minerals, pesticides and energy.

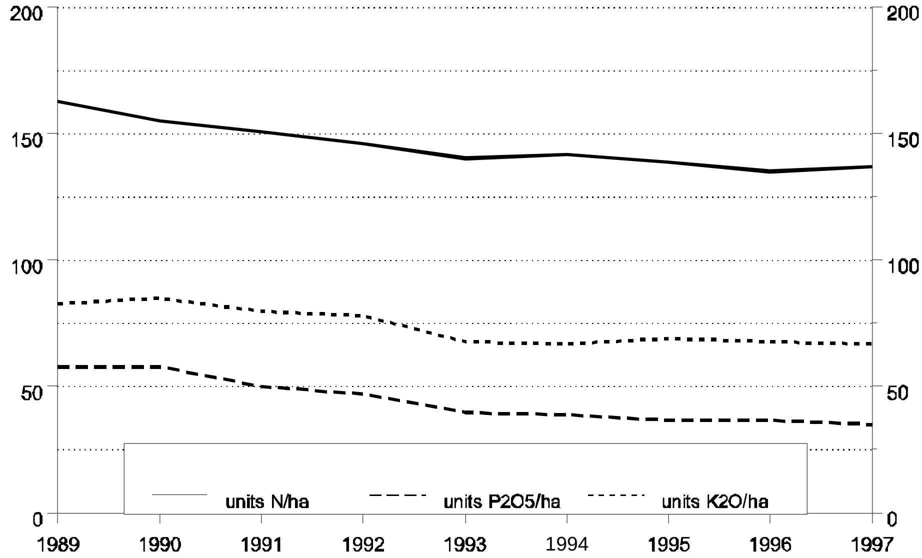
15.2 Use of minerals

In agriculture mineral surpluses are a very serious problem. They mean a danger for the quality of groundwater and also cause emissions to the air (e.g. ammonia). Especially regions with intensive livestock production (mainly pigs, poultry) like the Flanders, are confronted with serious mineral surpluses.

The supply of minerals can appear under different forms. Most important are manure, chemical fertilisers and feed. The removal of minerals can appear under the form of manure and produced agricultural products (crops, milk, eggs, animals, e.o.). How these are treated in the Belgian FADN is indicated in the next paragraphs.

15.2.1 Fertilisers

In the FADN the amounts of fertiliser that are bought and used are registered since some years. These data allow to calculate the number of units of nitrogen (N), phosphorous (P_2O_5) an potassium (K_2O) per hectare of land that originate from chemical fertilisers. Quite recently these data are split out allowing to calculate the units of minerals from fertiliser for each crop. In Figure 15.1 the evolution of the number of units N, P_2O_5 and K_2O given as chemical fertiliser per hectare at the average Belgian farm is presented. These figures were calculated on the basis of data collected in the FADN. One can observe that for each of the three elements the use per hectare has diminished. In 1989 163 units of N are given, in 1997 this amount decreased to 137 units. The use of P_2O_5 decreased from 58 units to 35, and of K_2O from 83 to 67 units. These data are concerning the elements given under the form of chemical fertiliser. This decrease is caused by the adaptation of the environmental legislation which was becoming more rigorous during that time period and limited the number of units of N that can be given per hectare. On January 23th 1991 the Flemish government issued a decree on the protection of the environment against nutrient pollution, better known as 'Mestactieplan' or MAP (manure action plan). Since 1993 this decree had a concrete effect as from that year on the transports of manure had to be declared to the Mestbank ('manure bank'). Nevertheless the decrease of fertiliser used per hectare that was stated in the FADN did not mean that less nutrients were used on the fields. Because of the growing concentrations of live-stock production more organical manure is produced which, because of the rigide environmental legislations, is spread out over the agricultural land. Consequently fertilisers are substituted by manure. In order to monitor the total amount of nutrients left on the fields it is necessary to registrate also the flows of manure in the accountancy.



Source : CAE

Figure 15.1 Evolution of the use of (chemical) fertilisers per hectare on Belgian farms (period 1989-1997)

15.2.2 Manure

The production of manure by the animals of the farm can be calculated on the basis of norms available for the different kinds of animals. Since the numbers of different kind of animals and the time they are present on the farm are available in the FADN it would be possible to compute the supply of N, P_2O_5 and K_2O. It can be noticed however that during last years the flows of manure between the farms are becoming more important. In Flanders the policy even consists of spreading the local surpluses in areas with intensive live-stock production over the other farms in the region or exporting the surpluses to other regions in Flanders. This subject was investigated in detail by dr. ir. L. Lauwers, researcher at the Center of Agricultural Economics (Lauwers, 1994 and 1995), who made intensive use of the data of the FADN for his research. As the manure flows among farms becomes more important one needs to register them in the accountancy, this allows to compute better data on the mineral use on the farms. Since the accountancy year 1998-1999 also the flows of manure among the holdings are booked in the FADN. The amounts of manure supplied from other farms and the amounts transported to other farms are registered for each kind of manure. For each kind of manure the content of minerals is determined on a fixed basis; these fixed coefficients are determined by the Flemish institute 'De Mestbank' (the Mestbank is a service of the Flemish government that controls the declarations of the use of minerals of the farms and supervises the flows of manure between individual farms). In case the real content of minerals in the transported manure is known (if the manure is analysed) it is evident that the real coefficients are applied. The registration of these data makes it possible to calculate the units of N, P_2O_5 and K_2O_5 applied per hectare of cultivated land. This figure gives a more complete picture of the applied manuring.

If we want a better picture of the average (total) amount of nutrients supplied per hectare for the different crops not only the supply of fertilisers per crop must be registered, but also the application of manure. The registration of the application concerns the manure produced on the farm as well as the manure supplied by other farms. Since the accounting year 1999-2000 these data will be registered in the bookkeepings. Based on this information a more complete picture can be obtained of the use of minerals per hectare for the different crops. This will allow extension services to give manuring advice and it will also provide a management instrument for the farmer and for the policy makers.

15.2.3 Minerals in feed

On live-stock farms, and especially farms with production of pigs and poultry, large amounts of feed are bought. This feed contains a lot of minerals. An important part of the feed is imported. Consequently a great part of the imported minerals are left on the land of the live-stock farms (or other farms) as manure. In the FADN the amounts of bought feed are registered and the bought feed is allocated to different categories of animals. Until now the composition of the different kinds of feed is not yet registered. In literature one can find indications on the average content of minerals of the feed used for several categories of animals. These indicators can be used (but with caution) for further studies. In the future there will be aimed to register also the minerals content of the different kinds of feed. This could be facilitated if there would be a legal obligation to mention the content of minerals on the invoices.

15.2.4 Supply and removal of minerals

In the future it will be more and more indicated to keep nutrient accountings to get a better insight on the nutrient flows. In the Netherlands MINAS was introduced, this is a declaration of nutrients (De Kreij, 1997). A lot of methodological work on nutrients accounting systems is already done in the Netherlands (Breembrok et al., 1996). In Belgium we are only at the start of such systems. The accounting system of the Belgian FADN is very appropriated to perform such kind of nutrients accounting systems. For the moment the flow of fertiliser and manure between farms is already known, and a lot of other information, although not everything, is available. However the mineral content of the feed is not yet registered. For the feed of some categories of animals average mineral contents are available in the literature.

The removal of minerals can, also on the basis of fixed coefficients of mineral content, be calculated on the basis of FADN data. In the accounts also the harvested (and removed) amounts of the different crops and animal products (milk, eggs, ...) are registered. Since a few years also the weights of the animals are registered at the moment of entering and leaving the farm, and also on the inventory dates. This makes it possible to calculate also the minerals entering or leaving the farm as meat.

Consequently there are already a lot of elements in the FADN allowing the set up of mineral balances of farms, although some gaps still have to be filled up. For example for the flows of raw feed among the farms the amounts still have to be registered, more information should be available on the feed and the amounts of seeds and plants used on the farm (although this last item only represents a small part of the supply of minerals). Furthermore it could be positive if the real content of minerals was known on the basis of analysis for some of the entries of minerals. At the moment the number of farms with results of analysis are very limited.

For the specialised pig farms efficiency of minerals is already calculated on the basis of FADN data (Lauwers, 1998). Some years ago some dairy cattle farms of the FADN were involved in a study dealing with mineral surpluses in live-stock farming. In this study accountancy data were used, these data were completed with data of analysis of feed from the holdings (Carlier et al., 1992). Finally there could be a collaboration between the FADN, that would supply accountancy data, and other research and experimental centres that would perform chemical analyses and contribute their technical know how to draw up criteria on nutrient use. In the Netherlands the importance of this kind of criteria is already recognised. These criteria offer the farmers an important tool for their nutrient management (Havinga and Mulder, 1995).

15.3 Pesticides

The use of pesticides can have an important impact on the environment. Fauna and flora can be influenced by the use of pesticides. Also percolation of pesticides to the ground water can cause problems with the provision of drinking-water (for example atrazin in drinking water). During last years more and more attention is payed to these problems. On the one hand biological agriculture, banishing the use of pesticides is becoming more important. In Belgium however the part of biological agriculture is only limited to less than 1% of the agricultural activities (Dua, 1998). On the other hand 'integrated agriculture' is becoming more important, 'integrated agriculture' still allows the use of pesticides, however in a more judiciously and environmental friendly way. In Belgium subsidies are given for integrated fruit production. In the future the use of pesticides must decrease in order to protect the environment. Consequently it will be necessary to monitor the use of pesticides. The FADN can play an important part in monitoring the use of pesticides if, in addition to the monetary value, also the amounts of pesticides are registered. On the basis of data on the use of commercial products the use of active components can be calculated.

In the software of the FADN the registration of the amounts of pesticides used is not yet possible. For the moment the Centre is carrying out a project to determine the use of pesticides per regio and for the whole country for some agricultural and horticultural crops. This project started since the accountancy year 1998-1999 and is carried out for the Department 'Kwaliteit grondstoffen en plantaardige sector' (Quality of raw materials and vegetable sector). For this purpose a special software was developed allowing to register not only the monitary values but also the amounts used of each pesticide. The bookkeeper can make his/her choice in a picklist containing all officially authorised products in Belgium. On the basis of these data and on the basis of the data of the Agricultural Census the use of pesticides is extrapolated to aggregates such as the agricultural region or the whole country. By means of an adapted software program the amounts of commercial products are converted into amounts of active components allowing to calculate the amounts of active components used. During the accountancy year 1998-1999 the cultures of barley, permanent and temporary pastures and apples are focused. In the next years other crops will be investigated.

Although this system will deliver good results it is regrettable that this kind of data collection is not integrated in a global information system including all accounting operations. In this case it would be possible to register the used amounts of pesticides for all crops. This integrated information system would allow to extrapolate the use of pesticides permitting to give a global picture of the total use of pesticides. It can be expected that in the near future the authorities will be greatly interested in this kind of data.

15.4 Energy

Horticultural holdings, and especially glasshouse holdings, are great consumers of energy. It is not surprising that since a longer period in the FADN for horticultural holdings in addition to fuel costs also the quantities of fuel are booked. Moreover the quantities of each kind of fuel were booked such as heavy fuel oil, gasoline, natural gas, paraffin oil, coal, electricity and so on. For each of these energy sources the energy content is known (Megajoule). By means of an extrapolation model the total energy consumption for heating the Belgian greenhouses can be computed (Van Lierde and De Cock, 1999b).

Energy consumption is a topical matter in the Belgian glasshouse horticulture. For economic and environmental reasons there is aimed for a more rational use of energy. On the one side there is the economical aspect. Although until last year energy prices were at a historical low level the glasshouse sector has to deal with a growing competition of producers in the southern countries of the Community who use less energy for the production of their crops (Van Lierde et al., 1999). These producers have an important advantage to compete with the northern glasshouse horticulture. The increase in energy prices in recent months accentuated the economical problem. On the other hand the consumption of energy has a negative environmental impact. The natural fossil fuel reserves are not inexhaustible and the emissions of CO_2 and other greenhouse gasses, released by the combustion of fossil fuels, contribute to the pollution of the environment. For all these reasons the Centre of Agricultural Economics (CAE) started up a project to study the energy problems in the horticultural sector. The energy consumption in Belgian greenhouse horticulture was monitored based upon the data of the Belgian FADN (Van Lierde and De Cock, 1999a, De Cock and Van Lierde, 1999b). Further more the efficiency of this energy consumption was calculated (De Cock and Van Lierde, 1999a).

When fuels are incinerated there is an important emission of CO_2, SO_2 and other greenhouse gasses. As in the accountancy network the kind of fuel is known, and as for every kind of fuel the emissions of CO_2 and SO_2 per unit of fuel is known, the total amount of emissions of both gasses that are released at the combustion of fuel for heating the greenhouses can be computed (Van Lierde and De Cock, 1999b). In Figure 15.2 the evolution of these emissions of CO_2 and SO_2 per square meter of greenhouse is represented for the period 1980-1997. One can notice that there is a strong decrease in the emissions of SO_2 in 1995. This can be explained by the fact that in 1995, as a consequence of different taxation, the extra heavy fuel became more expensive then the heavy fuel that contains a lower content of sulphur.

Figure 15.2 Evolution of the emission of CO_2 and SO_2 per m^2 glasshouse on the Belgian glasshouse horticulture (period 1980-1997)

Glasshouse horticulture is a great consumer of energy, but it is not the only sector in horticulture and agriculture to consume energy. Other horticultural and agricultural holdings also consume energy in different production processes. This energy is used for different purposes: tractors, other machinery, lighting, heating, drying, cooling, and so on. In order to expand the possibilities for further research we adapted the FADN data model some years ago. to collect more information on energy use and energy sources. For every kind of fuel the content of energy, in Megajoule, is known and also the quantities of fuel are known so the accountant can calculate the amount of energy used for each farm. Moreover, for the most important kinds of fuel used on farms (such as gasoline, heating oil, electricity) the quantities are registered in the Central database.

At the moment a research is going on in which the total energy consumption of the whole agricultural and horticultural sector in Belgium will be calculated. Also the emissions released at the combustion of these fuels will be determined. Using different analytical tools the energy consumption will be itemised over the different productions in agriculture; this research is still going on.

15.5 Conclusions

As in the article is shown the Belgian FADN is able to supply a lot of data that are necessary to determine environmental indicators. With some adaptations this data-model could even serve to support Life Cycle Assessments (LCA) research (Van Lierde, 1999). As presented in PACIOLI 3 the idea was to develop a global computerised information model integrating financial, technical and environmental data. It was predicted that in the years to come the demand for environmental indicators would increase in a considerable way. It was intended to incorporate in the data model the possibility of drawing up mineral balances, and enabling monitoring of pesticides or energy use (Van Lierde and Taragola, 1996).

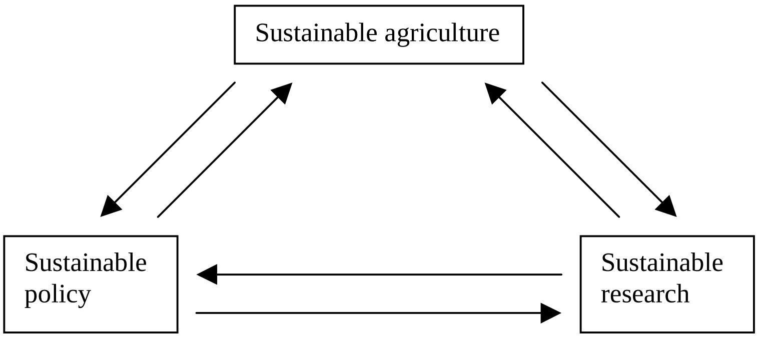
As predicted the policy makers are demanding now for environmental indicators. As a matter of fact in Agenda 2000 a lot of attention goes to the environment, this means that there is a great need for monitoring the environment. On the other hand the agenda for the development of the Belgian FADN was only partly realised. The environmental data that are collected today are not collected with the integrated software that was announced and of which a part was already realised in 1996. To collect the environmental data a 'spaghetti software' was developed, this is a solution that offers no advantages for future developments. To release the necessary staff for further developments of the integrated software and to facilitate the transition from the old system to the new one the temporary software 'DE FACTO' was developed (Van Lierde, 1999). The result was however that this temporary software 'DE FACTO' was considered as the definitive solution. The further development of the integrated software was put into the refrigerator as it was no longer considered as a priority. Time will tell what was the right choice and if the priorities that were fixed for the Belgian FADN agenda will yield rich rewards for future research.

Addendum

Nowadays people pay more and more attention to the relation between agriculture and environment. People become aware that modern agriculture where productivity, efficiency and profitability take priority, can exhaust the earth and can endanger the future. There is a need for *sustainable agriculture*. Sustainable agriculture is better for the environment but it should also procure a good income to farmers so that they can sustain. So sustainable agriculture needs a policy to make this possible. The policy makers should work out a policy that makes sustainable agriculture attractive and ensure its profitability. This requires a planning in the long term, so there is a need for *sustainable policy*.

Sustainable agriculture deals with a lot of technical and economical problems which require a solution. Sustainable agriculture asks the scientific world to examine these problems and to supply solutions. A lot of research is required, and this needs a planning in the long term. Nowadays the scientific world 'lives' on projects, that are in most cases limited in time. Once the project is finished and the models are ready for operating there is already a new item that has to be examined and the funds go to new projects. The researchers take up the new challenge leaving the functioning of their models to others, which means in most cases that they are no longer used. So important realisations are set aside to make way for new projects (Van Lierde and De Cock, 1999b). Fortunately this is not always the case but it proves that research requires also a planning in the long term, so there is a need for *sustainable research*.

Research needs funds, these funds have to be supplied by the governments and the agricultural sector. Policy makers and the agricultural sector should make long term plans about what should be investigated, and how the different research projects should fit in a coherent entity. For this planning they can be advised by the scientific world. So there is an intensive interaction between agriculture, policy and research and all three of them have to be sustainable.



As shown in the paper the FADN can be an instrument to measure in what way agriculture charges the environment with pollutants. Hopefully in the future the FADN can be an instrument that will measure *improvements* of the environmental performance of agriculture. But in order to improve the environmental performance of agriculture an optimal interaction between sustainable agriculture - sustainable research -sustainable policy will be required.

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16. Using a Farm Accountancy Data Network in data management for LCA

Krijn J. Poppe and Marieke J. G. Meeusen

Abstract

This paper discusses the usefulness of Farm Accountancy Data Networks for Life Cycle Assessment (LCA). It discusses which data can be found in the Farm Accountancy Data Networks and which are relevant for LCA. Several users are distinguished, each having their own requirements towards data. This forms the basis for requirements towards the data collection systems, of which the Farm Accountancy Data Network is one. The Farm Accountancy Data Networks can provide data from many farms at once and it can be used as a base for environmental models that help to estimate the emissions, which are necessary inputs for LCA.

16.1 Introduction

At the dawn of the third millennium, the agricultural sector faces two challenges: new scientific developments (e.g. biotechnology, information and communication technology) and - not unrelated - new demands from the society (e.g. requirements on environmental performance of products and production). Both challenges form the background of this paper where we discuss the use of the Farm Accountancy Data Network (FADN) for Life Cycle Assessment (LCA).

Executing LCAs of a(n) (agricultural) product requires a lot of effort and energy. In principle, a process sheet has to be made for each process that contributes to the environmental burden of the product. The process sheet covers the environmental and economic flows in and out the process. A lot of processes contribute to the whole life cycle of a(n) (agricultural) product and collecting data of all those processes is time and energy consuming, which makes LCAs still rather expensive. Even when we focus our attention just on the agricultural processes, where much more data are available than in other sectors, there is still a problem with data collection.

This paper discusses the use of the FADN for LCAs of agricultural products with the focus on the processes that occur within the agricultural sector. It starts with a discussion on the FADNs, as these data and the concepts used to collect them (large representative samples, typology, risk analysis) might be a useful additional source for LCA data management. After this introduction to FADN, we focus on the use of FADN data for LCA; we compare this type of data with data from non-accounting sources in agriculture, especially the engineering approach. The main theme of this paper is to suggest that the approaches used in (farm) accounting might be useful in the discussion 'how to collect data for LCA process sheets', and to develop some suggestions on the circumstances under which the FADNs have the preferred data collecting systems for the LCA practitioner.

The paper is written in a provocative way to make an exchange of ideas between LCA practitioners and FADN managers possible. Based on experiences of the authors, the paper provides suggestions and ideas that now guide the authors in setting up their discussion within the group of FADN managers (with LCA practitioners). The background of first author (Krijn J. Poppe) is not in engineering, but in farm accounting and auditing and our institute LEI bases a lot of its research on accounting data. This might colour our paper.

16.2 Introduction to the FADNs

16.2.1 General

Farm Accountancy Data Networks (FADNs) exist in all EU member states, as well as in Norway and in Switzerland and they are set up in Central and East European Countries. Non-European countries often have comparable business surveys. The background of these FADNs is the need for micro economic farm level data to monitor and analyse the agricultural policy. A FADN is a representative sample of farms. In the EU 60,000 farms are sampled on request of the European Commission (CEC, 1989; Abitabile, 1999).

The data collection on these farms is based on farm accounting. The results are available in the form of a number of statements, e.g. a farm structure statement, a balance sheet, a profit and loss account, a cash flow statement, and (in some countries) a gross margin statement and a mineral balance. Such statements describe the situation of an individual farm in a certain year. Although research institutes have access to data on (individual) farm level (which allows them to investigate e.g. the income and wealth distribution), the results are available to the public only as aggregated or average results for e.g. a certain farm type and the results are used as statistical information.

In a number of statements, values, as well as quantities are available. Monetary values dominate in balance sheets and profit and loss accounts, but often quantities on e.g. production and number of animals are also available. However, between member states the FADNs vary a lot with respect to the availability of these data.

16.2.2 FADN and LCA data about inputs and emissions

In order to execute an LCA of agricultural products one has to collect data about the inputs required for agricultural production and the emissions that are caused by agricultural production. Both can be found with the help of FADN.

FADN and data on inputs

The current European FADN provides only a limited number of data that could be useful for those who are studying the environmental impact of farming. These data typically include stocking rates, the area cultivated with irrigation, production levels (for the main products also in volumes) and monetary inputs of pesticides and fertiliser. These data can be mapped to (crossings of) farm types, regions, altitude level, farm size etc. Although this amount of data and its usefulness is somewhat limited (especially for those researchers who have access to a much more detailed national FADN as in the Netherlands), interesting studies can be carried out to assess the environmental impact of farms. An example is Brouwer et al. (1995) estimating mineral balances for all FADN holdings.

However, in recent years, FADNs showed an interest in collecting data for environmental purposes. These data can also be useful as an input to LCA. We mention the results of a recent project for the European Commission on the future of the EU-FADN, called RICASTINGS. It is clear from that study that five member states now collect mineral balances (Netherlands, Italy, Luxembourg, Portugal, Finland) and that another seven countries assess this as feasible if the finance would be available. It is also clear that eight member states have data on organic production, another six think this will be feasible. About half of the member states think that there is an interest in collecting data on pesticides, energy, and water, and that this is technically feasible (Abitabile et al., 1998). Van Lierde (1998) already made a study on energy use in the Belgian horticulture by using the Belgian FADN. This suggest that finance and organisation (bringing users and data providers together) are the main bottlenecks to have more data from FADNs available for LCA.

In the Netherlands there is quite a lot of experience in collecting data on the use of minerals, pesticides, energy, and water (Poppe, 1992). Already for many years now, accounting software in FADNs of research institutes like LEI in the Netherlands have collected these data. Data on the inputs mentioned above can be used to estimate emissions by using environmental models (see below). The data are collected on farm level. They are allocated to products, but this is not always done in the recording stage. Inputs are not recorded per activity, although Activity Based Costing (Schoorlemmer and Welten, 1998) could support this. In the Netherlands, this type of software has moved to the level of the farm or commercial accounting office. This is especially true for mineral accounting, where farmers are obliged to keep records on mineral flows, and have to pay a levy on surpluses. Compilation of these accounts benefits from special statements on the mineral content of products that are provided by farm suppliers, sometimes in an electronic data interchange (EDI) format. These statements are also used to audit the farmers' accounts (see Breembroek et al., 1996 for a detailed description of the system). The Dutch examples show that it is technically feasible to collect data on the environmental performance of a farm, on farm level.

FADN and data on emissions

Farm accounting typically collects data on inputs and outputs that are potentially environmental damaging. However, FADN does not necessarily provide information on the emissions towards air, soil, and water. To estimate such emissions, agronomists use environmental models. Figure 16.1 shows that these models form an important link between farm level data and an LCA. Where an LCA could use some data (e.g. production volumes) directly from a FADN, models would be needed to estimate the emissions that result from e.g. a surplus of N on the mineral balance. It seems that most of these models are difficult to generalise and can not easily be linked to data of individual farms without further calibration.

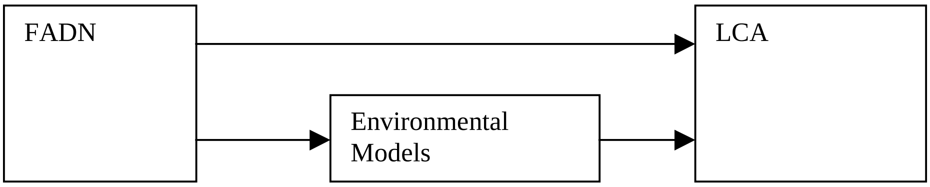

Figure 16.1 Relationship between FADN, environmental models and LCA

In the Netherlands, we have experience with the development and use of environmental models based on Farm Accountancy Data Network, e.g. the MAM and the Stofstromenmodel, the results of which are being used in national environmental monitoring programmes.

16.2.3 FADN typology and LCA

The FADNs use typology as a system that classifies farms. The classification method largely depends on the application and the user. In agricultural statistics farms are classified to their technical-economic orientation, based on the share of the different technical production activities (e.g. sugar beets, potatoes, wheat, eggs) in the estimated added value of the farm (Tiainen, 1998). This orientation (e.g. arable farms, specialist dairy farms) is calculated by multiplying the area of the crops and the number of animals with a standard gross margin (a 3-year average, standard for a region) and than looking to the share of different activities in that total farm added value (expressed in ESU - European Size Units). The total added value of the farm is also used to classify a farm in a certain size class. Typologies are also used for several regional dimensions (less favoured areas, 5B-regions, administrative regions like the NUTS nomenclature).

The FADN typology has an output-oriented component, which gives a useful link to the functional unit of LCA. However, for each study and each purpose of the study one has to ask whether the FADN typology is useful for the identification of farm systems on which the LCA has to be carried out. It can be assumed that better results for LCAs will be reached by dedicated typologies (e.g. intensive dairy farms on sandy soils). The only way to find this out is to perform these classifications and to look with multivariate statistical techniques whether better typologies can be developed.

16.2.4 The use of risk analysis [1] in accounting

Traditionally, LCA is very much an engineering tool where data are considered about all the processes that contribute to the total environmental burden. The same goes for process sheets: all the factors that contribute to the total emission of a process are taken into ac-

[1] The use of the term risk analysis might be confusing in an LCA context. It is not an environmental risk analysis, but an analysis to improve the quality of the accounting data.

count. This makes data collecting neither very cost efficient, nor very easy with the data collecting systems that farmers have. We should consider more cost effective methods to collect data to carry out an LCA: 'Why spending 80% of the costs on the last 20% of the data?'

Accountants use a technique called risk analysis to investigate the relevance of the data collection activities. By examining the risks of making errors in a data collection activity, and studying the causes of these risks, it can be determined how the data collection should be organised so that the information needed is as accurate as possible, given a certain amount of costs for the data collection. This can for instance result in spending a lot of costs on making data collection as error-free as possible for an important process (e.g. applying P_2O_5 fertiliser in spring time or on the previous crop) and not much, or even nothing, on a process that only contributes marginally to the end result (e.g. use of phosphate in plant potatoes used as seed).

It is obvious that such techniques can only be used under two conditions:

- first, a certain knowledge about the contribution of different sources and inputs to the emissions and their environmental impact is necessary. This requires the availability of many LCAs: then there is a base for the selection which factors are really important and which factors are less important;
- secondly, it should be noted that risk analysis requires a clear priority of the environmental issues that have to be considered and those who have less priority. To illustrate: destroying a few trees might be less problematic in Finland than in the Netherlands.

As long as one can not distinguish one or a limited number of relevant factors that cause emissions and environmental effects and one has no general knowledge about the contribution of several activities to the emissions and their environmental effects, applying a risk analysis to improve quality (versus costs) does not make sense. Relative to other sectors, like the building industry, the packaging sector, and the automobile sector, the agricultural sector seems to have less experience that allows for risk analysis.

16.3 A closer look at FADN data and LCA

16.3.1 LCA users and requirements on LCA data

To design a data collection system that provides LCA data, it is necessary to take into account the user and the background of the information-need of that user. There are two reasons for this necessity:

Information systems must provide information of a certain quality at an acceptable cost. However, quality is a user-based concept: There is no such thing as 'absolute' quality - and quality comes at a certain price. Quality can be defined as 'the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs' (ISO 8402).

LCA and data collection systems have a cost, and the user has alternatives if the collection system becomes too costly.

In this paper, we follow the user-based approach to answer the question: 'which data collection systems to use for with application?'

LCA users and applications

An LCA is carried out to provide a user or a group of (different) users with information. We distinguish two categories of users:

1. the agribusiness (retailers, food industry and farmers); and
2. the government.

For the agri-business (retailers, food industry and farmers) there is a number of decisions in which environmental issues and LCA play a role. There are decisions on product level - these decisions influence every firm in the production chain - and decisions on individual firm level.

1a. Negotiations with the government on environment regulations. The aim of the government is to reduce environmental effects of production. Therefore, the government wants to push firms to lower their emissions. However, firms are not always happy with such governmental interventions and need two sorts of information: Insight in potential strategies to cope with the effects of governmental intervention (see point d), and insight in their environmental performance compared to that of other sectors. By benchmarking with other sectors, they find arguments to reduce governmental interventions. This benchmark can be useful on product level (food compared to cars) or on sector-level (dairy industry compared to paint industry).

1b. Tracing and tracking. The issue of product liability and requirements from consumers for tracing and tracking becomes increasingly important. In case of food safety, the buyer exactly wants to know what activities have influenced the product(safety) and whether the quality control of such processes have worked (e.g. by installing ISO or HACCP procedures). This is not yet the case with environmental issues. However, one might expect this will be the case on longer term.

1c. Communication with the consumer - (Eco)labels. The environmental performance plays an increasing role in the quality-concept of (agricultural) products and an increasing number of consumers base their buying-decision on the environmental effects of the product. Therefore, consumers need information about the environmental impacts of products. The agribusiness considers two strategies to inform the consumer: Ecolabels, which cover only the environmental performance and where LCA is considered as the main tool in the procedure of developing labels (Green Goods V International Conference, 1998), and brand labels, which are based on the assumption that environment is not an issue as such, but an issue that forms part of the total quality of the product (safety, taste etc.), which is guaranteed by brand labels. For both strategies, firms within the agricultural production chain, especially those that produce for green-labelled products, face contractual obligations to report on the environmental aspects of their production. Until now, these obligations often centre on one product, for which (in an engineering approach) the activities have to be recorded. It has been argued elsewhere (Udo de Haas, 1996; Poppe, 1998) that - for farms - an ISO 9001 or 14000 procedure for the whole farm could make more sense, and can lead to audits that provides more guarantees and cheaper data (Meeusen-van Onna and Poppe, 1996).

1d. Improvement of environmental performance. All firms within the agribusiness are actively looking for options to improve the environmental performance of their agricultural products. In this decision making process several levels or stages can be identified: In the planning phase, the agribusiness needs information about the contribution of each activity/process to the overall environmental performance (Which processes contribute the most? e.g. the milk industry could ask: 'Is it the use of feed, the use of fertiliser, the use of energy in the milk production that contribute significantly?'). One can imagine that the outcome of such a study might lead to a revision of contracts (e.g. other criteria for labels), the implementation of other house-keeping systems (pigs in the Netherlands), purchase of other machines, lower stocking rates, to another transport system, moving production to regions were effects are smaller or to less environment friendly regions and moving out of this type of production. etc. These decisions often have a long term element. In the operational control in which 'every day' decisions are made. When the agribusiness knows that the use of fertiliser largely determines the environmental performance of potatoes, one needs information about the impact of the use of fertiliser in certain places, times and under certain weather circumstances. This information could be involved in the 'every day' decision processes. Consequently one needs information about the contribution of each process to the overall environmental performance plus information about how the contribution of each process can be lowered. Furthermore benchmark-information can be relevant. One can learn by benchmarking with (e.g.) the best 20% firms.

The governments need for information depends on the stage of the political process (see Meeusen-van Onna en Poppe, 1996 for more details). In the stage of problem recognition, there is mainly a need for fact finding to define and locate the problems. In policy formulation, representative monitoring systems and statistics have to be used in order to estimate the costs and effects of a proposed policy. The government should adapt its statistics and databases according to new realities as topics and policies change (Fletcher and Phipps, 1991). In the stage of implementing solutions, policies often evolve from extension and soft policies that include compensation for negative consequences of a policy, towards more severe, including the questioning of the necessity of production as such. Economic effects on micro-level are often a central issue in the discussion, as well as the efficiency of the policy. This requires detailed information. For example, the mineral accounting in the Netherlands, where farmers have to record the environmental impacts of their farm in an auditable way. The fulfilment of policies by e.g. farmers can demand simple taxes and auditable data for these levies. In the stage of control of the policy, the main need for information is monitoring, that leads to less detailed information needs than in the previous stages.

Requirements

The previous section provided an overview of the users of LCAs and the applications in which they use the LCA information. As every other information system, information systems must provide the required information of a certain quality at an acceptable cost (see section 1). The quality concept can be broken down into seven main criteria (Abitabile et al., 1998):

1. relevance: data are relevant when they meet the users needs;
2. accuracy: the closeness between the estimated value and the (unknown) true population value;
3. timeliness and punctuality: the need for up to date figures;
4. accessibility and clarity of the information: Accessibility is the best when data are available in the forms that users desire and when data are adequately documented;
5. comparability: Data of a certain characteristic have the greatest usefulness when they enable reliable comparisons of values taken by the characteristic across space and over time;
6. coherence: Common definitions, classifications, and methodological standards;
7. completeness: Users want a complete information system: the information system has to provide information on 'all vital aspects';

User/ application a)	1	2	3	4	5	6	7
Agribusiness: For negotiations with the government			Future-oriented		X	X	
Agribusiness: Tracing and tracking		X	Historical	X			X
Agribusiness: Communication with the consumer		X	Historical	X			X
Agribusiness: Improvement of environmental performance			Future-oriented		X	X	
Government: Stage of Problem recognition	X						
Government: Stage of Policy formulation		X		X			
Government: Stage of Implementation policy		X		X			
Government: Stage of Control		X		X			

Figure 16.2 An estimate of the relative importance of criteria per user/application

a) 1: Relevance; 2: Accuracy; 3: Timeliness and punctuality; 4: Accessibility and clarity of the information; 5: Comparability; 6: Coherence; 7: Completeness.

Finally, we consider the costs of the data collecting system in order to assess 'price-quality' ratio.

The quality criteria mentioned above are relevant for all LCA users and the applications of LCA in their decision making. However, in some applications certain criteria look more relevant than others. For example, an agribusiness needs data with much more detail when it uses an LCA for tracing and tracking or to improve environmental performance, than when using it for negotiations with the government to discuss an environmental bill.

Figure 16.2 provides some ideas about the relative importance of the quality criteria per user/application. We emphasise the fact that the scores are not based on scientific research; it is what we (and our colleagues) have experienced in our work.

16.3.2 FADN versus other data collection systems

This section describes two data collection systems for LCA process sheets. It is based on the way data on costs of production for an individual product on farms are collected in FADN. This section translates the experiences in that area towards the way data about the emissions in process sheets can be collected.

We distinguish two methods:

1. the (farm) accounting approach; and
2. the engineering approach.

We want to emphasise that these methods are in reality more complementary to each other than competitive. The so-called hybrid method that has been developed and applied at several Dutch universities, use of the top-down economic-statistical I/O analysis is combined with the 'bottom-up' process analysis. They are used in a complementary way. However, in order to help the discussion and to make the differences more clear, we characterise them on their own and probably a bit distorted.

Farm accounting approach

The farm accounting approach (or the survey approach), is based on accounting information collected from a large sample of farms in a FADN. Every farm in the sample is representative for a group of farms (with more or less the same characteristics). This is secured by using a farm typology (see section 2). Information about these farms is (very) detailed recorded by the farmers themselves or the accountants.

Data on quantities are collected on both inputs and outputs, and can - with the help of the farmer - be allocated to products in the case that farms produce different products. Internal flows within farms (manure from animals to crops, straw from crops to cattle) are also recorded by farmers, although this can imply estimations at the farm. The emissions, specified to impact categories, is estimated by environmental models.

The (environmental) accountant is trained to work top-down, by looking mainly to relevance. Translated to LCA data for process sheets one might think about the following procedure: the accountant tracks the 'responsible' factors for the emission and then assesses which factors have the highest contribution to the emission. He will then concentrate his efforts on collecting and auditing detailed data about these factors. Other factors will be recorded on a more aggregated level with fewer efforts.

Advantages of this approach is that results are representative for a (well defined) group of farms, that there is information about distribution of emissions, and that the information is auditable.

Disadvantages of this approach is that harmonisation of data is required (each farmer and/or accountant has to use the same rules to fill in the forms and information system) and that in some cases the environmental impact has to be estimated, especially if environmental models are not available.

The engineering approach

The engineering approach is based on technical coefficients for the (processes on an) average farm in a given region. Coefficients are often provided by experts, based on their experience and on a one-time questionnaire among farmers (that have to remember their 'normal' yearly practice when they answer the questionnaire).

The engineering approach works bottom-up. It is an inventory of all factors contributing to the total emission of a process.

The advantage of the approach is that the effort of data-collection is focused just on the technical coefficients. Consequently, one has only to know the (changes and developments of the) technical coefficients in order to draw up the process sheet.

Disadvantages of the approach are:

- that it can only be used for a short period of time because in the long run structural changes happen that go far beyond the change of individual technical coefficients so that other formulas have to be developed;
- that the results are not necessarily representative for the country/region as a whole. The average farm does not necessarily have average production and/or an average emission. When this causes too many problems, one has to define another type of firm (see section 5: typology). For example, to calculate the production costs, a 'modern farm' is chosen in stead of the average farm;
- the lack of information about the distribution of the emissions among farms, assuming that only a small number of farms are surveyed.

Comparison of data collection systems

The information provided above can be summarised in a comparison of the two approaches in data collection versus the quality aspects of information that we discussed before. Figure 16.3 provides our estimate of the relative differences between the two approaches.

In Figure 16.3 we suggest that the engineering approach in data collecting for an LCA leads to very complete and relevant data at low costs, but the accuracy and coherence with other information can not always be guaranteed. The accounting approach has the disadvantage that it can be expensive and provides a historical view. It becomes even more expensive if one does not support the accountants' practice to concentrate on the most relevant emissions ('spot-light administration', see section 2), and wants data on all emissions allocated to all products and processes. The advantage is that distribution is available, representativeness is documented, data are audited, and integration with other types of data is facilitated.

The high costs of the accounting approach is a point for further discussion. If the data-collection for LCA can be seen as a by-product of the accounting information, a marginal cost calculation can be defended. This is especially the case in FADNs that provide policy makers and researchers with data. A second point is that the huge changes in information and communication technologies have a bigger effect on the accounting approach than the engineering approach.

Quality aspect	Engineering approach	Accounting approach
Costs of collection	Relatively low	Relatively high, due to high number of farms surveyed
Relevance	OK- (no distribution of variance of data is available)	OK+ (distribution of variance of data is available)
Accuracy	OK- (technical coefficient are often been estimated by experts - at best by questionnaires)	OK+ (data are audited, description of the representativeness if possible using the typology of the FADN)
Timeliness	Often more actual data or even future data	Based on historical data (unless extrapolation is carried out)
Punctuality	OK	Less, there is a risk of delay in the accounting process
Accessibility	OK	OK- (sometimes data are not available due to privacy restrictions)
Clarity	OK	OK+ (methods are often better documented)
Comparability in space	OK if well defined typology of farms	OK if well defined typology of farms
Comparability in time	OK on short term Not OK on long term	OK
Coherence with other data	Often not, but definitions of emission models and LCA can easier be taken into account	OK
Completeness	OK+ (very complete; all (sub) processes have been considered)	OK- (less complete due to the focus on major (relevant) processes, with a category 'other' for less relevant processes)

Figure 16.3 Scores a) of two data collection systems on quality criteria
a) Symbols: OK stands for: a good score on this criterion; OK- stands for a good score but with one minor point (compared to the other data collection system); OK+ stand for a good score with an extra point (compared to the other data collection system).

16.3.3 Conclusion: Towards a contingency theory?

The information presented above raises the obvious question: 'Can suggestions be made on the choice of the best data collection systems to perform an LCA, given certain circumstances?' Based on the analysis of the use of LCA in section 3.1 and the analysis of the differences between the two data collection systems in section 3.2, Figure 16.4 provides our suggestions for a contingency approach: 'In which case is the engineering approach superior to the accounting approach of data collection, and vice versa?'

The analysis suggests that the engineering approach for the LCA data collection systems is especially interesting for strategic producer decisions and in the problem recognition stage of governmental policy making. The engineering approach then delivers future oriented and rather cheap data on an average farm system. Accuracy of data is less important. A risk of applying the engineering approach in these cases is that too much time is spend on collecting information on processes that do not contribute to the overall assessment of the environmental impact of the production process.

	Engineering approach	Accounting approach
Agribusiness: For negotiations with the government	X	
Agribusiness: Tracing and tracking		X
Agribusiness: Communication with the consumer		X
Agribusiness: Improvement of environmental performance	X (strategic level)	X (operational level)
Government: Stage of Problem recognition	X	
Government: Stage of Policy formulation		X
Government: Stage of Implementation policy		X
Government: Stage of Control		X

Figure 16.4 A contingency approach in the choice of a data collection system for LCA

The accounting approach for the LCA data collection system is especially interesting if a close look into the data of more than one firm is needed. If a food company would like to monitor the production process of all its supplier or even (as a chain leader) would like to improve the environmental performance in the food chain, or if the government would like to formulate and defend efficient policies, an accounting system is superior. A striking insight is that this need for detailed information will not always lead to a requirement for detailed data on the environmental effects of separate processes.

As environmental decisions are more and more incorporated into all types of decisions, and as the incorporation of environmental aspects in accounting is within reach with only marginal cost increases due to a number of innovations (see Poppe et al., 1997; Beers et al., 1999), a move from the engineering approach towards the accounting approach can be expected in the data supply for LCA.

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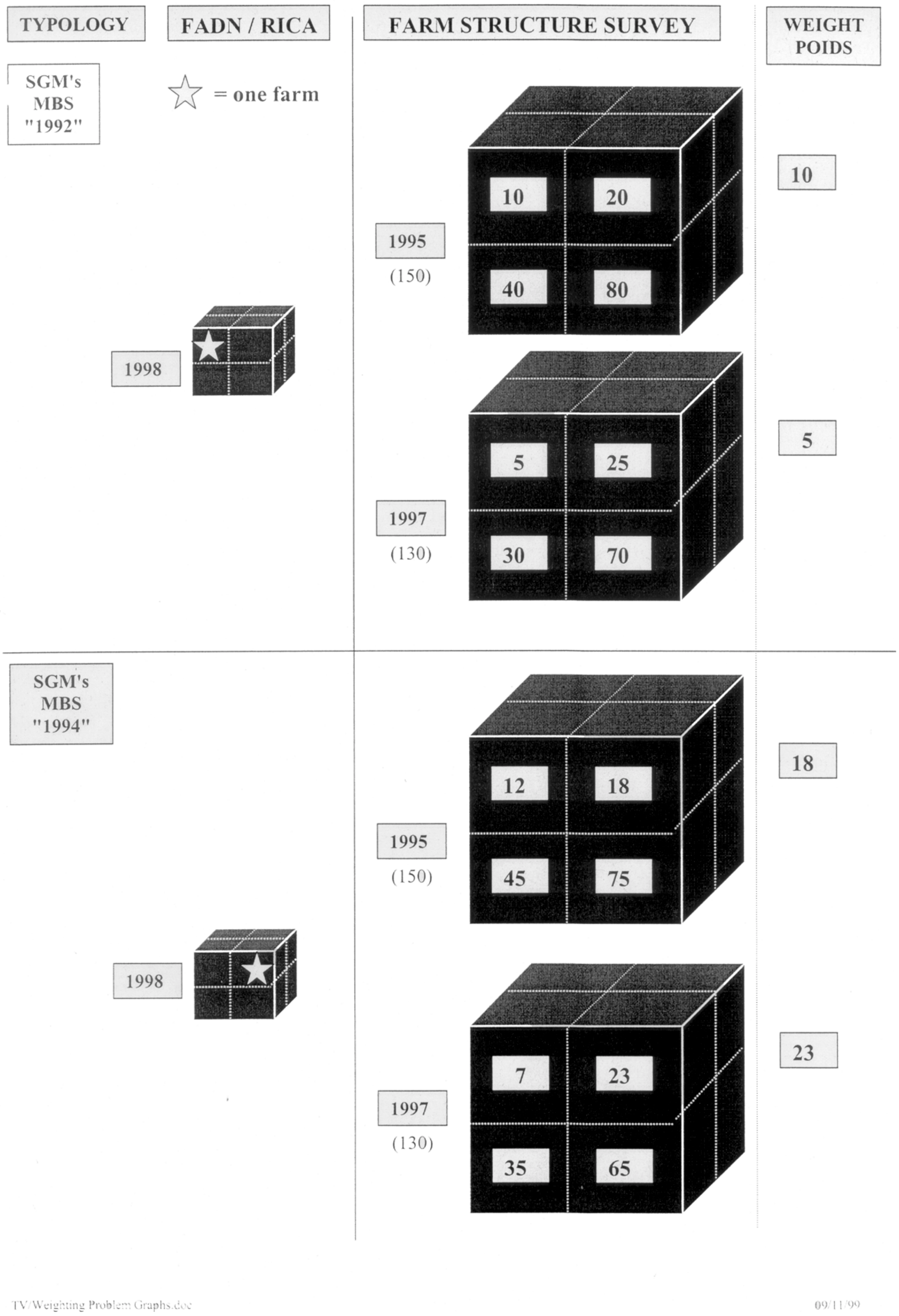
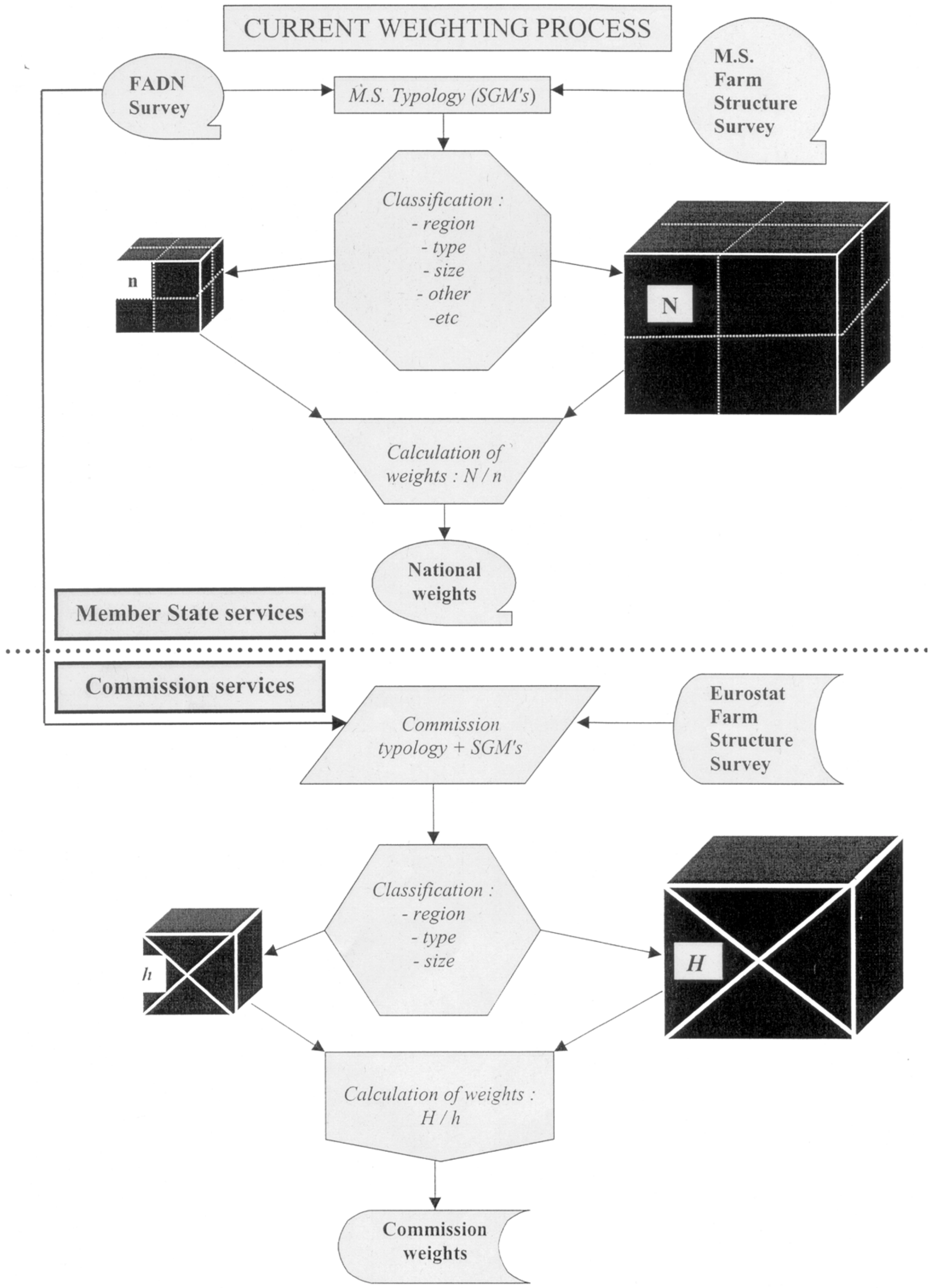
17. How to improve the weighting system of EU-FADN results?

Thierry Vard





TV/Weighting Problem Graphs.doc 09/11/99

18. EC Reg. 1257/99: is it possible to finance farm accountancy?

Susanna Perachino [1]

Abstract

INEA gives particular attention to EC Reg. 1257/1999 because of the support for rural development and in relation to the project for new financial framework Italian RICA at national and regional level.

The RICA data recording costs should be shared between all participants: in 1998 EC Regulation 950/1997 aid represented 38.48%.

According to Agenda 2000, in particular rural development Regulation, form improvement scheme isn't necessary any more for investment aids and accountancy keeping doesn't have any more incentive payments.

Anyway these Measures introduce some important requirements. Firstly, a support should be granted for the setting-up of farm management services, secondly support is required for vocational training and acquisition of the skills needed to manage an economically viable farm.

This means that a business budget has to be drawn up and data recording should obtain financial support.

The Italian Regions seem to be inclined towards providing support for farm management services through recording accountancy incentive payments.

Keywords: Accountancy, accounting, financial, management, training

18.1 Introduction

Two important steps regarding Common Agricultural Policy (CAP) bring the end of the millennium: firstly the Agenda 2000 Measures, secondly the beginning of WTO negotiations.

Currently every Member State puts a lot of effort into the variation introduced by some European Commission Regulations (EU Reg.). One of these is EC Reg. 1257/1999 on support for rural development (EU Reg. 1750/1999 lays down detailed rules for the application of EC Reg. 1257/1999).

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INEA (National Institute of Agricultural Economy) represents the Italian RICA delegation and gives particular attention to that Regulation according to the considerable RICA rule at national and regional level.
New financial framework for Italian RICA is in progress because of the relevant recording costs.

18.2 Change the way in which Italian RICA is organised

18.2.1 ISTAT - INEA agreement

The project starts with the integration between RICA and the research of Economic Results in Agriculture (REA).

In fact, last April the two Institutes signed the agreement on suitable realignment of INEA accounting methods to collect RICA and REA data just using the INEA accounting software.

On the one hand, it's necessary to refine the regional collected data network; on the other hand, the statistical sampling should become the random sample which is a derivation from the list of Structural Samples. The reason is that Italian RICA has been added to the Third Multilateral Agreement between the Ministry of Agriculture, the Regions and the National Institute of Statistics (ISTAT) regarding agricultural statistics.

Next October the General Census of Italian Agriculture will begin. The Census returns will probably be out in 2002; concerning these results Structural Samples should be revised.

18.2.2 Financial system for Italian RICA data recording

- According to the framework for 1998 financial sources are the following:
  - EC Reg. 950/1997 (ex EC Reg. 2328/1991) : 38,48%
  - Regional laws : 49,93%
  - INEA : 0,64%
  - Others : 10,95%

- Total costs for RICA data recording should be shared between all participants as Regions and INEA do, etc.

Farm accounting assistance has been financed by Structural Funds up till now in Italy (in particular incentive payments for accountancy keeping due to EC Reg. 950/1997).

This approach is considered to be appropriate because:

a. farm economics information is requested;
b. national and regional funds are often inadequate;
c. RICA represents the unique source, officially recognised both at European and national level, able to give some additional information in order to evaluate not only rural development policy.

Moreover, a European Regulation fixes the standard fee per farm return for the accounting year in 126 ECU at the present.

Last June a State - Regional Committee approved the document concerning guidelines on the 2000-2006 programming period of the Structural Funds for agriculture and rural development.

According to this document, the Minister of Agriculture provides the guidelines and application criteria on EC Reg. 1257/1999 and ex-ante evaluation about planning documents.

Therefore, these guidelines are directed at Regions who are responsible for rural development plans.

The last reform of the Structural policy contents doesn't provide incentive payments on accountancy keeping expressly; consequently the financial framework for RICA needs other forms of support.

18.3 The reform of the Structural policy

EC Reg. 1257/1999 introduces the support for rural development from the European Agricultural Guidance and Guarantee Fund (EAGGF). In this context the most important issues in order to indicate the change are:

a. rural policy isn’t carried out through a range of instruments any more: there's one simplified instrument;
b. rural development Measures contribute to policy in Regions whose development is lagging behind (Objective 1) and Regions facing structural difficulties (Objective 2):
    - objective 1 areas: Operational Programmes integrated with Structural Funds;
    - objective 2 areas: Rural Development Plans;
c. form improvement scheme isn’t necessary any more for investment aids;
d. accountancy keeping doesn’t have any more incentive payments (on the contrary of EC Reg. 950/1997).

18.4 Details about EC Reg. 1257/1999

The Regulation on support for rural development provides rural development plans proposed by Regions on the 2000-2006 period.

In accordance with Article no 43, rural development plans shall include:

a. a quantified description of the current situation;
b. an appraisal showing the expected effects;
c. a description of the Measures contemplated for implementing the plans, in particular the points for assessing the rules of competition;
d. a definition of quantified indicators for evaluation.

According to Article no 49 it’s established that the evaluation of Measures covered by rural development programming shall be carried out on the basis of the principles laid down in Articles no 40 to 43 of EC Reg. 1260/1999 which are referred to ex-ante, mid-term and ex-post evaluations.

Article no 33 says that *support shall be granted for Measures like the setting-up of farm management services.*

In general, this support seems to be available just during the initial period; consequently different financial sources should be provided for the following period.

Article no 9 seems similar to Article 13 EC Reg. 950/97; in fact, it provides the *support for vocational training and acquisition of the skills needed to manage an economically viable farm.* In accordance with this rule farmers have to improve their vocational training.

18.4.1 The Italian situation

Italian experience shows management accounting is not widespread. One reason is that a farmer as individual person isn't obliged by law to draw up the business budget at the present.

If new fiscal law were approved, it could become a necessary requirement as it is normally in other European countries.

Anyway it seems obvious that farm performance evaluation requires data recording and the drawing up of the business budget as RICA does.

Moreover, the training could move two farm groups:

a. vocational farms provide management accounting on their own;
b. development of farm management services for 'smaller' farms.

Articles no 5 (chapter: Investment in agricultural holdings), no 8 (chapter: Setting up of young farmers), no 26 (chapter: Improving processing and marketing of agricultural products) of EC Reg. 1257/1999 say any support shall be granted if economic viability can be demonstrated.

This means: firstly, a business budget has to be drawn up, secondly data recording needs financial support.

On the contrary, Standard Gross Margin (SGM) application doesn't seem an alternative solution because of the contrast between farm structural data basis and rural development plans requirements. Moreover,

- SGM are up-to-date until 1994 (1996 is in progress);
- SGM have classification goals;
- SGM exclude forestry.

Conclusions

In accordance with rural development *Regulation RICA data has to be used as an evaluation instrument for rural development policy and farm training and management services.*

In general, farm economics information is frequently required for evaluation, research, operational research, etc.

The Ministry of Agriculture, the Ministry of the Treasury, Universities, etc. need data.

INEA manages RICA Data Bank to answer in advance any demand through transparent interrelationship.

Moreover, every Administrative Region presents different aspects and solutions available.

The Italian Regions seem to be inclined towards the following choices:

- use of the INEA accounting software as a management instrument to evaluate any claim;
- according to Articles no 9 and 33 EC Reg. 1257/1999 general understanding on providing support for farm management services through recording accountancy incentive payments.

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19. Towards a new RICA: presentation of prototypes for data exchange and data checking

Anne-Mie Wauters, Teppo Halonen, Tieto Enator Corporation, Finland

19.1 Presentation

The software of the FADN system in DG-Agri is currently renewed. This started with a project that created a new database in SAS to store the FADN/RICA data. This work (now labelled RICA-2) is currently enlarged with two new projects. One is the creation of a tool to improve the dessimination of results (labelled 'RICA-3'). Another ('RICA-1') is the replacement of the EU's software for submitting and checking the national FADN data as an input to DG-Agris FADN database.

Tieto Enator, the software company that has been contracted by DG-Agri to develop RICA-1 and RICA-3 presented this project. The project was a bit behind schedule and therefor a prototype could not yet be shown. However the plans for building it, were presented. It will be a tool based on web technology, that helps national liaison agencies to submit data from individual farms tot the database, that will be checked on an individual bases directly. This moves the data entry from batch processing towards smaller batches or individual farms. Checks that involve larger groups of farms (e.g. because they are based on distributions) can only be carried out later, which implies that an accepted farm can in a later stage also be subject to additional inquiries.

More information on the projects RICA-1 and RICA-3 is available (already updated to include latest views) in RI/CC documents presented to the RICA management committee by DG-Agri, and therefor not reprinted here.

19.2 Discussion

The workshop was very pleased with the fact that Tieto Enator as well as DG-Agri was willing to discuss and learn from each other on these innovations in a workshop like PACIOLI 7. A number of issues were raised in the discussion. These included:

- a warm welcome, especially from the research side, for a better distribution of this important public data;
- the software seems to be flexible on the point of the number and type of check points that can be formulated and applied. It is however not clear which check points will be included in the first version, and some persons were concerned that this would be the current ones. In their view these check points need a revision as they are creating to much error-warnings on non-errors, where some other aspects are not really checked;

- in addition it was remarked that the RICASTINGS study found out that the main function of the checking does not seem to be to check the quality of the data in the member states but to audit the member states' conversion programme. In other words: has the objective of the process been given enough fundamental thinking?;
- it was advised to make the software as open as possible, so that member states could learn which check points are or will be used. The member states were advised to built in these check points at the lowest possible level of data gathering (that is at farm/accounting office level, in national accounting systems) as data correction is than cheapest and quickest.

20. Questions and answers

Participants were invited to raise any subject they would like to discuss and others are invited to comment or provide help.

The participants from Central European countries presented the work in progress on their FADNs.

Dragi Dimitrievski: in the Former Yugoslavian Republic of Macedonia the FADN is still to be put on the drawing board, but this is planned for next years.

Krista Kõiv: in Estonia the Training and Advisory service has already carried out substantial work and data is available.

Szilárd Keszthelyi: Hungary seems to be ahead with a database for 1998 of 1400 farms, although not all regions are covered yet and data from the Farm Structure Survey to assess the representativity is still missing. Exchanging data with DG-Agri is planned for 2000, to support the negotiation process.

Knut Samseth raised the issue of accounting for intangible assets like quota. He would be very interested to learn practices in other countries and invited reactions by e-mail that could then be included in his paper. A remark was made on having a look too to the new IASC Exposure Draft on Agriculture as a bench mark.

Hans-Hennig Sundermeier presented the work in progress in Germany to integrate production records in pig farming into accounting. The work was fuelled by incentives in the advisory service to cut costs on data gathering. As most of those farmers keep their accounts with the main accounting office (which has ties to the farmers' organisation), the organisational problems can be tackled.

Hans-Hennig Sundermeier also proposed to investigate (perhaps in a next workshop) the possibilities for product-differentiation in accounting. Especially a differentiation to the live cycle of the farm family seems promising (young farmers, investing and being in debt have other information needs than nearly retiring farmers). It was remarked that this could perhaps be broadened to the issue of mass-customisation.

Iraj Namdarian suggested to have a look at the impact of the developments in the world wide web, and especially Java and XML to exchange data and databases.

21. Follow-up

The workshop PACIOLI 7 was very stimulating and judged as a success.

Results participants evaluation

Number of respondents: 16

Question	Part of the programme	Average rate
Please rate the following part of the programme from 1 to 10, with 1=poor and 10=excellent	Papers on Agenda 2000	8,0
	Papers on prototypes for data exchange and data checking	8,1
	Papers on accounting issues and IASC-Exposure Draft	7,0
	Papers on Rural Enterprises	7,6
	Papers on Environment and LCA	7,7
	Excursion	7,5

Question	Answer
Is there a need for PACIOLI 8?	14 participants: yes 2 participants: no answer
Suggestions for topics PACIOLI 8	- Experience with ARTIS
	- Mixed subjects
	- New FADN returns
	- Comparison between organisation and philosophy on new data modelling at farm level; software products developed and planned
	- Harmonisation (of definitions in accountancy)
	- Rural Development
	- Landscape Valuation
	- Accounting issues on balance sheets
	- Candidate countries FADN
	- Environmental accountancy
	- Efita approach

The participants were in favour for a follow-up: PACIOLI 8. It was suggested to organise this in one of the candidate countries. The workshop management suggested to discuss PACIOLI 8 more in detail in the beginning of 2000, as this made some reflection after the workshop possible. Concerning the location, a place in central Europe was seen as OK, on the condition that the theme and issues would be as innovative as in previous workshops. It was not thought appropriate to dedicate PACIOLI 8 to the development of FADNs in candidate countries only, as this is guided by several Phare projects and co-ordinated by the European Commission. However it could be useful to learn from the newest technology that is installed there.

Any news on the PACIOLI network will be published on the website of the LEI (www.lei.wageningen-ur.nl).

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