PACIOLI 10
European farmers and the growing of data

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- ☐ Chains
- ☐ Policy
- ☐ Institutions, people and perceptions
- ☑ Models and data

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The Pacioli network explores the needs for and feasibility of innovation in farm accounting and its consequences for data gathering for policy analysis in Farm Accountancy Data Networks (FADNs). PACIOLI 10 was held in Motta di Livenza, near Venice, Italy, in December 2002. This workshop report presents the papers. In the 10th Pacioli workshop special attention was given to a number environmental topics, using micro data. Other topics include policy models, farm safety nets, corporate social responsibility, software development, representativity in data networks and farm auditing. In addition results of the workgroup sessions on the creation of a thematic network are reported.

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Preface

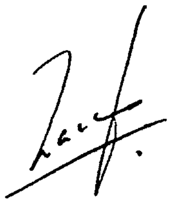
Innovative ideas face many hurdles to become successful implementations. This is also true in farm accounting and in Farm Accountancy Data Networks (FADNs). Therefore it makes sense to bring together the 'change agents', the persons that have a personal drive to change the content of their work and their organisations, to adapt them to new circumstances. For farm accountancy and policy-supporting FADNs it is appropriate to do this in a European context: this creates possibilities to learn from each other.

It is with this background that the PACIOLI-network organises a workshop every year. This small but open network has become a breeding place for ideas on innovations and projects.

This report is one of the more lasting results from the 10th Pacioli workshop, held in December 2002 in Motta di Livenza, near Venice in Italy. We are indebted to our Italian colleagues of INEA for the local organisation. The dedicated support of mr. Andrea Povellato and his team of INEA in Legnaro resulted in a very pleasant seminar. We thank Guido Bonati and Carla Abitabile of INEA in Rome for the original invitation to come to Italy, and for their long time support of the Pacioli network. We are indebted to the Veneto region for financing the publication. Helga van der Kooij managed to get the papers and the results from the work group sessions in a readable workshop report.

Pacioli 10 was a very successful workshop. Many ideas were shared between the participants. We are very pleased that the participants would like to see our network continued also after the first 10 workshops. Our Polish partners volunteerd to organise Pacioli 11 in 2003 and Switzerland took an option on Pacioli 12. We hope that this workshop report gives the readers the incentive to take part in those events. Look at www.pacioli.org for more information.

Prof. Dr. L.C. Zachariasse
Director General LEI B.V.



1. Introduction

1.1 The PACIOLI network

Decision making by farmers becomes more complex as economics, new agricultural policies and environmental aspects demand integration. Information systems require adaptation and there is a special need for innovation in farm accounting.

The objective of the PACIOLI network is to assess the need for and feasibility of projects on the innovation in farm accounting and its consequences for data-gathering on a European level through the *Farm Accountancy Data Network* (FADN/RICA). Interaction with data-users in micro-economic research is promoted, to support feed-back.

PACIOLI was originally a Concerted Action funded by the EC under the AIR specific programme of the Community's Third Framework Programme for Research and Technological Development and managed by DGVI.FII.3 (AIR3-CT94-2456). After completion of the contract with the PACIOLI 4 workshop, the partners decided to keep the network alive at their own costs.

For PACIOLI 10 we returned to Venice, the place where the scientist Pacioli once published his famous work on double entry accounting. In this workshop special attention was given to a number of environmental studies that make use of micro-economic data. This report contains the papers in the order of presentation in the workshop.

1.2 Programme PACIOLI 10

Location: Villa Rietta Rota (Centre Studi e Formaizione)
Via Zampagnon 2, Motta di Livenza

Sunday, 1 December 2002

Travel from Venice airport to Motta di Livenza

19.30 Departure from Marco Polo airport to Motta di Livenza

20.15 Arrival and registration at Omnia Hotel and Villia Rietta Rota

21.00 Light dinner (VRR)

Monday, 2 December 2002

8.00 Breakfast

8.45 Travel to Villa Rietta Rota with minivans

9.00 Welcome and introduction
Andrea Povellato, INEA, Italy: welcome to INEA -Veneto and Venice
Krijn J. Poppe, LEI, Netherlands: Introduction to the programme of PACIOLI X

Plenary Session I
9.45 *'Farms and databases - the Italian case'*
Guido Bonati and Giorgio Seroglia, INEA, Italy

10.15 *'Expression of interest 6th framework programme EU'*
Krijn J. Poppe, Agricultural Economics Research Institute (LEI), Netherlands

10.45 Break

11.15 Workgroup session I
The EoI and ICT driven datahandling / project identification

12.30 Lunch (VRR)

Plenary Session II
13.30 *'Environmental accounting applications in Italian FADN farms and forests*
Maurizio Merlo, University of Padua, Italy

14.00 *'Environmental data at farm level: tools for farm management'*
Bernard Del'homme, ENITA Bordeaux, France

14.30 *'FADN data to produce indirect statistics on the use of pesticides and to define the spatial distribution of plant diseases'*
Andrea Fais, Istituto Nazionale di Economia Agraria, Italy

15.00 Break

15.30 Workgroup session II
The EoI and environmental issues and other policy changes/project deliverables

Plenary Session III
16.30 *'Regional Integrated Model Using FADN and Administrative Data Bank'*
Filippo Arfini, Universtity of Parma, Italy

17.00 *'Building models with FADN data: an application of interactive group modelling'*
Hans Vrolijk, Agricultural Economics Research Institute (LEI), Netherlands

17.30 Snack

18.00 Plenary Session IV
'Agenda: a new tool for sustainable farm management
Carlo Giupponi, University of Padua, Italy

18.30 *'Social accountability reporting'*
Koen Boone, Agricultutal Economics Research Institute (LEI), Netherlands

19.00 Workgroup session III
The EoI and FADN data for modelling/stakeholder analysis

20.00 Dinner (VRR)

22.30 Travel to the Hotel

Tuesday, 3 December 2002

7.30 Breakfast

8.00 *Travel to Villa Rietta Rota with minivans*

8.30 Plenary Session V
'The representativeness of the Spanish RICA Survey'
Carlos San Juan, University Carlos III, Madrid, Spain

9.00 *'Measuring representativity of FADN-results - a methodological framework - a note for discussion'*
Beat Meier, FAT, Switzerland

9.30 *'The Safety Net for Farmers in Comparison with the General Population: Experiences from the U.S. and the Netherlands'*
Craig Gundersen, USDA, Economic Research Service, USA
(co-authored by Krijn Poppe and Susan Offutt)

10.00 Break

10.30 Workgroup session IV
The EoI and representativity and comparison with other countries/first steps to do

12.30 Lunch

Excursion

14.00 *Departure from VRR by bus to Airport harbour*

15.00 *Departure from Airport harbour by water bus (trip along the lagoon: Murano, Arsenale, Lido, San Lazzaro degli Armeni, San Servolo, San Giorgio and ending at San Marco square)*

16.00 *Riva degli Schiavoni: starting point of the guided tour*

GUIDED TOUR: Riva degli Schiavoni, Ponte dei Sospiri, Piazza San Marco, Palazzo Ducale, Basilica of San Marco, Calle dei Fabbri, (quick stop for capuccino / chocolate and refreshments), Gran Canal, City Hall, Rialto, Salizzada San Lio, campo Santa Maria Formosa.

19.30 *Dinner at 'Mascaron' with fish food*

22.45 Leaving from Piazzale Roma to Omnia Hotel and VRR by bus.

Wednesday,4 december 2002

8.00 Breakfast

8.45 *Travel to Villa Rietta Rota with minivans*

9.00 Plenary Session VI
'Experiences in data collection with on line Internet'
Michaela Lekesova, VUZE, Czech Republic

9.30 *'Full costs approach of EU dairy production'*
Petra Jägersberg, FAL, Germany

10.00 Break

10.30 Workgroup session V
The EoI and FADN implementation in Candidate Countries/know how needed

11.45 Questions and answers session

12.15 Information on Pacioli-11 / Closing / follow-up

12.30 Lunch (VRR)

14.00 *Travel to the station or airport*

2. Farms and databases: the Italian case

Giorgio Seroglia, Guido Bonati, INEA-Italy

A great number of different organisations is in charge of gathering data from farms, for various purposes. Even if we don't examine the private sector (which is mainly interested on information from farmers for marketing or accounting reasons), and we take into account only the public sector, during the same year a farmer can provide data to the national agency in charge of paying grants and subsidies, to the local chamber of commerce, to the farmers' organization, to the social security system, to producers' associations, to animal health authorities, to quality certification companies, to statistical institutes and to the FADN system.

All of these organisms (the list is however incomplete and could be extended as a result of local situation or of productive features of the farm)often store data on advanced IT system, that could allow a simple communication and integration. However, most of the databases are not homogeneous and little interaction occurs.

Although the information collected by each organism are different in quantity and quality, there are wide areas of overlapping, for which the duplication of databases is not fully justifiable. As an example, there are several ways of conceptualizing and identifying even a farm.

Concerning other farm data, and in particular those concerning structural aspects, multiplying data acquisition leads to the following disadvantages:

- farmers are contacted and have to provide the same basic data (i.e. the farm location) many times during the year. Besides the burden and the extra-effort that this requires, errors due to wrong data input are more prone to happen;
- each organism in charge of data collection is not able to exploit synergies and benefits deriving from the crossing of different sources of information.

Taking into account recent EU recent EU regulations, that correctly aim at:

- identifying beneficiaries of grants and subsidies in a unique way;
- adopting techniques of monitoring and evaluation.

The present paper will analyse:

- the existing sources of information;
- the typologies of data stored and the different coding schemes;
- the possible overlapping and interrelationships between different sources;
- the potential synergies consequent to proper data integration.

Apart from technical features, integration of personal, economic or fiscal information requires also an adequate legislative framework. This problem will be examined, with specific reference to regulations concerning the use of statistical data for others purposes and the protection of personal data from non-authorized access.

At the end of this analysis a number of different scenarios will be examined, in order to envisage an improvement over the existing situation, in terms of both quality and speed of data collection, control and utilisation. Specifically the unifying role of FADN will be examined, with reference to:

- the possibility of integration between structural statistics (primarily those necessary for the attribution of the EU typology) and administrative information, establishing a hierarchy that allows at least a reciprocal compatibility;
- the changes to apply to FADN itself, to improve its representation of agriculture, data quality, and speed in data analysis.

3. Expression of Interest for a Network of Excellence: network for ICT driven innovation in policy supporting data collection

George Beers, LEI, Netherlands

The 6th Framwork Programme of the EU gives the possibility to organise Networks of Excellence. The text below contains the text of a proposal written in the summer of 2002. It is the basis for the workgroup sessions in the workshops.

3.1 Summary

To evaluate and monitor policy, a wide variety of data collecting systems are implemented in regions, countries and at the EU-level. These instruments produce statistical and other information to give actual insight in de progress of a variety of policy objectives. Recent years the statistical networks are confronted with dynamics due changing policy objectives and to international harmonization of policy and thus with the monitoring of it. Also the progress of and new opportunities offered by Information and Communication Technology give room for more effective and more efficient data collection instruments and exchange of information. The network proposed brings together the professionals involved in data collection and aims to exchange knowledge and experiences with innovation of data collecting networks.

3.2 Need and relevance

The proposed network of excellence complies with thematic area 1.1.2. Information Society technologies. The specific type of application, data collection for policy support, has to deal with a lot of issue mentioned in this thematic area. A very important aspect is integration; integration of statistical data collection systems at regional, national en EU-level. Integrating large scale databases with different platforms, datastructures, multilingual environment and different dynamics give interesting challenges on the field of data management, user interfaces and related software technologies. Another aspect refers to the integration of data collecting systems with the information system of the data sources (e.g. companies). In this area there are interesting challenges in the e-inclusion domain. Not only the business-to-administration but also interfaces to link the data collection systems to business processes cover interesting challenges; technological as well as organizational. A lot of data collection system have confidential business information as a source; herein security and protection of privacy are crucial factors for reliability of the statistics produced by these systems.

New types of data representations (pictures) data sources (machines) will be included in statistical data collection system. Technological challenges in connecting new datasources in a flexible and reliable way will make policy supporting data collection more effective and efficient. Extending the different types of data and connect the various distributed databases, requires als more sophisticated interfaces, surfaces, search and retrieval facilities and representation techniques. The ultimate objective of the proposed network is to support policy makers by providing them with the best information available using sophisticated, state of the art ICT.

The activities of the network are:

- organizing workshops for professionals involved in information production for policy support to exchange knowledge and experience on innovation in the data collecting systems;
- integrating activities in different countries for innovation of data collection system by sharing resources and knowledge;
- offering a platform for advising EU-data collection systems;
- develop projects to innovate data collection systems EU-wide;
- make expertise on data collection available for accessing EU countries.

3.3 Excellence

This proposal builds on the experiences of the so-called PACIOLI-group. This is a network of professionals in data collection for monitoring agricultural policy. The group is established as a concerted action in the 4th EU framework programme. The concerted action ended in 1998, but the group has continued meeting once a year in an informal way. The group exists of professionals involved in Farm Accountancy Data Networks (FADN) and supports the formal representatives in the official EU-FADN committee. During the years the group has extended in nationalities as well as in scope. A lot of participants are involved in different kind of statistics with simular problems and challenges.

The expertises involved in data collection are:

- economy;
- statistics;
- information management;
- informatics;
- software engineering;
- accountancy;
- management science;
- innovation management.

The feasibility of bringing together a critical mass of expertise is expected to be very high. Based on experiences with the PACIOLI group it can be stated that professionals are working distributed all over Europe in a very specialized domain. These specialists, working in small groups distributed all over Europe, are dealing with the same kind of problems and challenges in their work. Usually the professionals that realy do the work in this area are not meeting their collegues working in other countries or other areas of statistics. The international meetings in this area are usually in a formal way with official national delegates in official EU-committees.

The success of PACIOLI showed that there is a huge need to meet and discuss in an open (non political) environment on a professional basis on the details of a very specialized profession of statistical data collection. Sharing experiences and knowledge has significantly contributed to innovation in data collection instruments in many countries in the EU. Another important aspect was that a lot of participants were coming from new accessing countries. With the help of the PACIOLI group (in projects as well as colleagal advices) they were supported in establishing data collection systems in their own countries.

The group that supports this expression of interest is:

Country	*Institute*	*Leading Academic*
Netherlands	Agricultural Economics Research Institute (LEI)	Prof.dr. George Beers Dr. Krijn Poppe
Italy	INEA	Dr. Guido Bonati
France	ENITA Bordeaux	Dr. Bernard Del'Homme
Belgium	Centre of Agricultural Economics	Dr. Dirk van Lierde
Estonia	Jäneda Training and Advisory Centre	Dr. Krista Kõiv
Finland	MTTL	Dr. Heikki Lehtonen
Germany	Federal Agricultural Research Centre	Dr. Werner Kleinhanss
Hungary	AKII	Dr. Szilard Keszthely
Ireland	Teagasc	Dr. Tommy Burke
Norway	Norwegian Agricultural Research Inst.	Dr. Knuth Samseth
Sweden	Swedish Univ. of Agricultural Sciences	Prof. Dr. Bo Őhlmér
Spain	ITG Ganadero SA	Dr. Juan Intxaurrandieta
Czech Rep.	VUZE	Dr. Michaela Lekesova
Denmark	Danish Agricultural Advisory Centre	Dr. Gert Giversen
Switzerland	FAT	Dr. Beat Meier
France	INRA	Dr. Vincent Chatellier
Germany	Landwirtsch. Buchfuhrungsverband	Prof. Dr. Hans-Hennig Sundermayer
Iceland	Agr. Economics Inst of Iceland	Dr. Jónas Bjarnason
Sweden	Statistics Sweden	Dr. Gunnar Larsson
EU	Commission DG Agriculture	Dr. Yves Plees
Croatia	University of Zagreb	Dr. Mario Njavro
Poland	Inst. Of agr and food economics	Dr. Darius Osuch
Latvia	Latvian State Institute of Agricultural Economics	Dr. Valda Bratka
Turkey	State Institute of Statistics	Dr. Filiz Ersoz
Lithuania	Ministry of Agriculture	Dr. Snieguole Pucinskaite
Spain	University Carlos III Madrid	Prof. Dr. Carlos San Juan

This network of professionals that are involved in collection and use of agricultural statistics, is a good basis for starting up a network of excellence as proposed. The group represents a balanced mix between the expertises mentioned. The concept of this network of excellence is that there is a basic group of about 25 professionals. Each workshop meeting will have a focus on a special issue. Depending on this issue the basic group will be extended with specialists on the special issue. These specialist (e.g. internet technology, data dictionary application, large scale object oriented databases) will be recruted from the network of the basic group. The special issues will be on advanced ICT application and on the application domain. In this application domain the basic group has a focus on information in agricultural policy; however this domain is extending to subjects as rural policy, food related policy (e.g. food quality and food safety).

By the partners involved in general statistics the link with a wide variety of other domains can be included in the agenda quite easy.

3.4 Integration

The participants in the network all have their own activities and reponsabilities at a national level. By sharing their knowledge and discussing their experiences, participants can improve their own performance in their own environment. Based on experiences sofar the effects of picking up experiences and knowledge from other countries have been a very good incentive to meet at a regular basis. The professional knowledge has been used to upgrade the national FADN systems in different directions:

1. By using new ICT opportunities the efficiency of existing systems can be improved.
2. Changing policy issues (e.g. Agenda 2000) have changed the information requirements of policy makers. Innovation of the content of the information systems has been a process that needs to be continued.
3. Integration of data on EU-level has been a process that is profitable for the commission but also as benchmarks for policy makers at the national level. Sharing data between countries has been a significant contribution for policy makers and policy oriented research. Sharing data has been facilitated by harmonization of data definitions but more and more by sharing data and data definitions. By conversion technology (e.g. data dictionaries) more data from different sources can be made available and can be used at different levels.
4. Bringing together professionals of national FADN's has been a very fruitfull platform for the commission to be advised on possibilities to realize information systems on EU-level. Succesful examples of this expertise based cooperation between the commission and member states can be found within DG6.
5. Bringing together knowledge and experience of existing data collection system has proven to be a very effective instruments to help (accessing) countries to set up new policy oriented information systems in their countries. The platform has been helpful to bring people together that could generate effective projects in various programs.

The key factor for a succesfull network as proposed is to bring professionals together from different member states and to facilitate a discussion based on expertise and take care that discussion is not influences by national political arguments. The separation of political discussion in the official channels and the professional discussion in the informal expertise network, has proven to be a very benificial formula for the policy makers in the end.

Workgroup Session I: The EoI and ICT driven data-handling/project identification

General introduction to the Workgroup Sessions

Being a workshop, we have the good tradition in PACIOLI to have a number of interactive sessions, in which we exchange ideas, learn more of each other interests and look for joint projects. in PACIOLI X we will have 5 of such workgroup sessions. Central theme in PACIOLI X for organising the discussions is the Expression of Interest called 'Network for ICT driven innovation in policy supporting data collection' that George Beers has submitted to the EU's 6th framwork program on behalf of the PACIOLI network. The Expression of Interest (Eol) is reprinted elsewhere in this book.

Let's assume that the EU likes this proposal and asks us to make a detailed research proposal for this topic. We have then to submit a much more detailed proposal with a number of working packages. Working packages are groups of projects.

For our workgroup sessions we assume that the final proposal will have 5 working packages, roughly based on the 5 directions in which the FADN systems have been upgraded in the past:

1. using new ICT opportunities to improve efficiency of current FADN systems;
2. changing information requirements in FADNs as policy issues change'
3. sharing data between different stakeholders like the regional, national and EU level, with effects on harmonising and conversion and a reduction in the administrative burden;
4. using improved data by better modelling for even better information products for farmers and policy makers;
5. platform to bring professionals together to learn from each other, especially beteen old, new and potential EU members as well as with trading partners like the USA.

For each of these Working Packages we will have to dream up projects, deliverables, methodologies etc. In the workgroup sessions we will use different techniques to write our research proposal. We will do this with a rolling agenda - which means that in session II a new group can be added to the lists of I and II before going on:

1. make a list of 5-7 potential projects in the working package with a short description;
2. make a list of project deliverables for the projects from session I;
3. make a list of stakeholders for the working program with do's and don'ts;
4. make a list of first steps for the program: what would you do tomorrow if you became leader of that working package today;
5. make a list of the know how needed to do the work in the working package and performance indicators needed to see if we realise our objective in the working package.

To dream up the projects, deliverables etcetera, we will have inspiration from the papers presented in the PACIOLI X workshop: after each plenary session with paper presentations we will form 5 small discussion groups to work on one of the Working packages, inspired by the presentations. The plenary sessions and therefor the workgroup sessions will have the following topics:

I. ICT and data handling;
II. Environmental issues and other policy changes;
III. Using FADN data and modelling;
IV Representativety and comparison with other countries/sectors;
V. FADN implementation in Candidate Countries.

As usual we will mix the persons in the groups so that we have many possibilities to interact with each other.

Instructions

Task: Make a list of 5-7 potential projects in the working package with a short description. Write these projects with a short description on a flipchart and a blank sheet for presentation. Try to use a brainstorming technique to identify the projects.

Group A

Working Package: Using new ICT opportunities to improve efficiency of current FADN systems.

Instruction on the task: try to find projects in which new ICT opportunities are explored for FADNs.

Example: 'Data precision agriculture: use the data from milking robots to gather data on milk yields'.

Group B

Working Package: Changing information requirements in FADNs as policy issues change.

Instruction on the task: try to find projects in which data needs from changing policies are gathered with ICT.

Example: 'Data on subsidies: could be gathered by link between FADN and databases on subsidies'.

Group C

Working Package: Sharing data between different stakeholders like the regional, national and EU level, with effects on harmonising and conversion and a reduction in the administrative burden.

Instruction on the task: try to find projects in which data exchange is supported by new ICT opportunities.

Example: 'Data exchange by GIS-systems on internet server'.

Group D

Working Package: Using improved data by better modelling for even better information products for farmers and policy makers.

Instruction on the task: try to find projects in which new products for farmers or policy makers are created by improved ICT technologies.
Example: 'Cash flow forecasts based on electronic payment data within a year'.

Group E
Working Package: Platform to bring professionals together to learn from each other, especially between old, new and potential EU members as well as with trading partners like the USA.
Instruction on the task: try to find projects in which new ICT opportunities are used to improve the sharing of experience between countries.
Example: 'Monthly Pacioli Video conference with webcams and internet

Groups for the workgroup session
'The EoI and ICT driven datahandling / project indentification'

Group A - Using new ICT opportunities to improve efficiency of current FADN systems
G. Bonati (chairperson)
A. Karlsson (reporter)
V. Bratka
A. Szelagowska
P. Jägersberg

Group B - Changing information requirements in FADNs as policy issues change
K. Boone (chairperson)
T. Borbas (reporter)
P. Nino
Z. Kubikova
S. Schiavon
A. Fais

Groep C - Sharing data between different stakeholders
H. Vrolijk (chairperson)
A. de Cicco (reporter)
G. Lech
I. Martini
A. Varendi
A. Povellato

Group D - Using improved data by better modelling for better information products
F. Arfini (chairperson and reporter)
B. Del'homme
C. Gundersen
M. Lekesova
M. Aamisepp

Group E - Platform to bring professionals together to learn from each other
B. Meier (chairperson)
A. Kinsella (reporter)
M. Merlo
P. Doria
U. Toic

Results workgroup session

I - A Use ICT-opportunities to improve efficiency

1. Handcomputer: incorporate farmers database

2. Feasability study for data integration (IASC, FADN - Animal, etc.) bankinvoices

3. Portal information to farmers:
   - Input FADN data
   - Decision support system
   - Help to apply for grants

4. PS location of farms

5. Internetbased data collection: from farmers, from local offices

6. Mobile phone data input (3G)

7. Videoconferences

8. Simple system for FADN

I - B(2) Changing information requirements

1. How to manage and integrate already existing environmental data (water irrigation system: water use in different regions)

2. Investigate the possibilities to collect new data

3. Comparison of data on pesticide use (Holland) with indirect statistics

4. Investigate the possibilities to connect data from FADN and IACS - landscape

New data: farm location and land use integrated with geographic data.

I - C Find projects in which data exchange is supported by new ICT opportunities

1. To exploit internet possibilities: To have 1 portal to enter all different 'agridatabases'
   To have 1 common shared platforum

2. ICT diffusion: To stimulate farmers to provide new data
To stimulate institutions to provide back information

3. Data warehouse: find yourself data: GIS, FADN, Agr.stat, EU-level, regional level, etc.

4. Decision making support system: To provide information to farmers, policy makers
Need of data models

5. Bridge databases: common destination

6. Build an 'intelligence system' to enter data, to check data, to speed up the use of database

I - D Better modelling

1. Timely information for farm management
   - Cost
   - Fiscal aspect
   - Prediction

2. Managing risk using FADN: software tools

3. Off farm activities : cash flow forecast

4. Improve planning at regional level: GIS, FADN

5. Auditing a regional level using a combination with FADN and ICT

6. Accurancy quality data with intelligence system

I- E (2) Platform to bring professionals together

SOME QUESTIONS

1. Who's is filling DB?

2. Database management - output only as good as input

3. Who is using the forum?

4. Data should be compiled in easiest way possible

Rules	Instructions	Coördination
	Recources	Incentives

SUB PROJECTS

1. What contents?

2. How management - how to make it work?

(video conferencing on adhoc basis)

ICT opportunities - improving sharing of experience between countries

ICT not just a tool: - network
- set of rules

1. Build website: www.experts.org - forum / newsgroup
- database

2. Fields	Experts (persons)	Institutions
	Publications	Projects

4. Providing agro-environmental diagnosis at farm level: needs and perspectives from French situation

Bernard Del'Homme, Jérôme Steffe, Marilys Pradel [1]*, Enita de Bordeaux, France*

Abstract

For more than ten years, environmental issues have been appearing in our lives, on a planetary scale as well as on a local scale. In both these general aspects as well as its specific concern, agriculture is affected by such changes. For years now, the French National and the common agricultural policies have taken into account this environmental dimension in their overall orientation. Integrating environmental issues means defining numerous concepts that agriculture must deal with and putting reglementation into place. Our purpose is not to debate the international dimension of agriculture but to see what occurs at the micro-economic level (the farm level) to include in a farm management diagnosis today's environmental issues.

After defining the main aspects of a farm agro-environmental diagnosis, we will present several methods used in France today. We will then present future needs and the foreseeable evolution in this domain. We will assess how possible it is to integrate these new needs into the farm information system, and discuss relevant software products.

Keywords: Agro-environmental diagnosis, farm information system.

4.1 Introduction

A first question when we want to understand what can be done at farm level when integrating environmental issues is to define what environment means. Two sciences used in farm diagnosis have an answer: Economy and Ecology. Thereafter, it is useful to define what is the meaning and the main goals of a farm agro-environmental diagnosis.

We will then present future needs and the foreseeable evolution in this domain. We will assess how possible it is to integrate these new needs into the farm information system, and discuss relevant software products.

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4.2 What is a farm agro-environmental diagnosis

1. Environment: economic approach

In economy, environment is a word currently used. If we try to apply this concept in management activities at farm level, we can give two main definitions:

- *environment*: external assets and constraints that a farm has to deal with;
- *environment*: place of mutual influences and exchanges between a farm and outside.

In economy, environment is defined with economic and social functions. It has influences on farm activities in the way it gives opportunities or restrictions. But the content itself of environment is not clear. It's a place or a set of assets influencing farm activities.

In France, most of management diagnosis methods use these definitions. In agriculture, especially one method deals clearly with environment in an economic sense: it is called 'farm global approach' and has been set up by a research team during the 70's.

2. Environment: ecological approach

From an ecological point of view, environment also has definitions:

- e*nvironment*: medium of physical, chemical, biological and social factors defining the frame in which an organism lives;
- *environment*: set of qualities of a biophysical medium used by an activity and transformed by an other.

In this way of thinking, environment is more considered as a physical medium. In the agricultural field, this natural medium can be soil, air, water, landscape for example.

Of course if we consider these two approaches of environment, we don't take into account exactly the same notions. Environment thought during the last years is mostly the ecological point of view. This is the reason why we will focus on this approach.

3. A farm agro-environmental diagnosis

Introducing environmental issues in farm management diagnosis still means that we are in an advising field. Three main ideas have to be underlined in order to better understand what we mean by such a diagnosis.

Diagnosis meaning

As any diagnosis, a farm environmental diagnosis should provide three levels of knowledge:

- presentation of indicators used;
- explanations of indicators level;
- evaluation of indicators.

For this last level, a judgement has to be done. References are often required in order to pass judgement. This clearly means that a diagnosis should not only be the description of a situation, but has to give an evaluation. That is why the diagnosis method has to be oriented in this way.

Indicators meaning
In order to make a diagnosis, we need information on which we can present, explain and judge the farm situation towards environment. Such information is named indicator, this means a quantification and simplification of a complex phenomenon in order to communicate on it.

Main qualities of such indicators should be:

- clearness (understandable);
- easy to get (measurement);
- relevance (based on scientific rules);
- representativeness.

Based on the diagnosis goals, indicators will often be collected through a specific survey at farm level, then they can be integrated in a database process.

Concerning environment, indicators can be collected at several levels.

Scales of environmental diagnosis
An environmental diagnosis based on indicators in agriculture can be applied on different scales, defining the observation level and indicators concerned:

- below the farm level (plot level, herd level);
- at farm level itself;
- over the farm level (natural or administrative area, basin, valley, ...).

Each environmental diagnosis method has it's own scale. A complete environmental diagnosis often requires a combination of these different scales. The scale can also be determined by the goals of a diagnosis.

Main goals of an environmental diagnosis
Two main goals are today identified which request an environmental diagnosis:

- *farm management*
  As each diagnosis domain at farm level (production, finance, marketing, ...), an environmental diagnosis has to give to the farmer an evaluation of its farm situation, in order to provide him advises. Diagnosis is clearly made to improve management level in the farm, this means improving the decision process. Improving agricultural practices towards environmental respect, or combine economic approach and ecological one are often goals attempted.
- *agricultural policy*
  As environment is more and more integrated in the agricultural policy, farmers have to give more and more results on their practices towards environment to get subsidies. Several measures depend on the ability for the farm to provide such diagnosis. And it will be more and more needed in the future.

In France, since 1999, a new national agricultural orientation law recognises officially 'multifunctionality' in agriculture. This means that a farm has not only a role in production, but also in land set up, in development of employment, in protection of environment.

In order to set up this evolution, a new type of contract has been created (Contrat territorial d'exploitation, C.T.E., or land management contract). It allows a farmer to get subsidies for 5 years if he is able to provide a project in which he shows that he will improve environmental and territorial issues and economic aspects of his farm. An environmental diagnosis is required in this C.T.E.

Once we have defined a farm agro-environmental diagnosis and its goals, it is possible to look for main diagnosis methods used in France, in order to have an overview on what is done in this field.

4.3 Which methods exist in France ?

If environment is a quite recent idea in the agricultural field, some methods exist for several years which deal with this approach. That's why we will divide this part in 2 chapters: old methods and actual ones.

We have chosen to present here the 3 main methods we can find these last years in France.

1. Indigo

Author:	National research institute in agriculture (INRA)
Birthday:	1990's
Objectives:	Advises on integrated production practices on plots.
Principles:	- Farm sustainability evaluation with agro-ecological indicators, - 2 types of indicators: method indicators, impact indicators - Evaluation of cultural techniques and crop systems towards environment.
Indicators:	- Method: crop rotation indicator - Impact: 10 indicators (pesticides, nitrogen, phosphorus, irrigation, energy, organic material, soil work, soil cover, ecological structure)

Each indicator is evaluated by a note, which scale is based on disposal knowledge on this indicator.

Two main results are given : one report at farm level showing strong and weak points on farm cultural practices, one report at plot level in order to give further information for decision at this level.

This method is quite flexible and simple, and can be useful for improving crop practices. Its main disadvantage is that it is based on plot measurement, so this method is not really relevant for a whole farm diagnosis. And as it is based on plot level, breeding farms are not well evaluated with such a method.

2. Solagro

Author:	Non governmental agency
Birthday:	1990's
Objectives:	- Evaluation of environment at farm level, - Advises for farmers for production systems improvements, - Availability for all types of farms.

Principles: 2 parts in the diagnosis:
- one based on 16 agronomic indicators (on soil, water, landscape)
- one based on a qualitative approach of farm agronomic practices and their effect on environment.

Indicators: 16 based on:
- nitrogen balance sheet and nitrogen risk,
- phosphorus and potassium balance sheet,
- crop protection system,
- physical and biological soil diversity,
- biological diversity,
- resources management.

Those indicators are often combined with an energetic analysis and a global synthesis of farm activities.

Results can be presented with tables or graphs like following.

Error! Objects cannot be created from editing field codes.

Figure 4.1 Graphic representation of Solagro method

Solagro method is a simple method, easy to lead, which provides results useful for farm management as for policy decisions. A software has been developed (DIALECTE) in order to compute the indicators collected and their reports. It's mainly relevant for combined farms, and less for specialised ones. It requires good knowledge on environmental issues.

3. Idea

Author: Ministry of agriculture
Birthday: 1990's
Objectives: - Evaluation of agricultural systems towards sustainability,
- Methodology for agricultural teaching.
Principles: 3 independent scales of sustainability, based on 37 indicators:
- Agro-ecological sustainability (17 indicators),
- Socio-land sustainability (14 indicators),
- Economic sustainability (6 indicators).

Each scale provides a note (scoring) which is gathered finally for one evaluation.

Indicators:

Agro-ecological scale:
- vegetal and animal diversity,
- area organisation,
- agricultural practices.

Socio-land sale:
- food and land quality,
- employment and services,
- ethic and human development.

Economic scale:
- viability,
- independence,
- transmissibility,
- efficiency.

IDEA is the most recent diagnosis method integrating environmental aspects. Created by teachers, researchers and professionals from the Ministry of agriculture, this method is a global one, including other fields than the environmental one. It is available for all types of farms, and it is quick and simple to implement it. Of course, it should be completed with more analytic approaches in order to get a real and complete diagnosis at farm level. As it is a new method, some points are able to evolve during the next years, especially scoring problems (weight of each scale in the final note, compensation between different indicators) and references for a better judgement of the farm situation.

Even if these methods are quite different, they are similar in providing a specific answer to the agro-environmental diagnosis (each method is more or less relevant to a specific kind of farm).

These methods have now to be included in the general management method of a farm. Some software products have, therefore, to be developed so that we can easily apply these methods.

4.4 How to integrate environmental methods into the farm diagnosis

1. What are the needs?

Needs evolve very quickly in this domain and we now face two kinds of needs: providing an agro-environmental diagnosis to improve farm management, and responses to regional or national issues.

Needs at farm level

The first need in this domain is, of course, to improve the agricultural practises of the farmer. This improvement should have two kinds of consequences:

- at technical level: a better respect for the environment (reducing, for example, nitrogen fertilizers or pesticides spread on the farm, water consumption, energy ...);
- at the financial level: a gain if the farmer becomes able to produce the same quantities while using less quantities of pesticide for example, or a competitive advantage when selling products (organic farms ...).

These aspects of the diagnosis are well-known today but are not always put into practise.

A second type of need which is more and more acute is the necessity to produce an integrated diagnosis at the farm level including financial as well as environmental aspects.

In France, a lot of accountant offices fear to become less and less competitive if they focus their advice activity only on financial aspects. Agricultural production is becoming more and more industrialised and it is becoming, therefore, easier to apply generic tools and diagnosis methods from industry to the agricultural sector. For this reason, accountant offices will face new competition from big industrial actors.

The only way to survive is to produce a specific diagnosis method which would be well adapted to the agricultural sector. This specificity is today constituted solely by the recognition of environmental aspects.

These will have to be treated in relationship with other aspects (financial and social). That means that it has already become necessary to combine all these approaches into an integrated diagnosis method.

Needs at a collective level

The need to integrate environmental aspects incoming to a diagnosis is not only required at the farm level but also at the national level.

First of all, there is an increasing social demand for this sort of information. Consumers now request quality products and want to know exactly how they were produced. Treaceability has, therefore, to be included in the farm information system.

Secondly, there is a social demand to safeguard and preserve rural areas. Farmers are often considered as polluters and they have now to account to society at large for their stewardship.

To answer this double social demand (from the consumer and from the inhabitant), policy makers have identified a general orientation defined by the Common Agricultural Policy, as well as national regulations.

On the national level, this translates into both coercitive measures and incentives.

The French State is developing specific subsidies for farmers who will respect the environment, preserve the landscape and respect good land use practises.

Since 1999, the government has set up Land Management Contracts ('Contrats territoriaux d'exploitation'). This is a contract between a farmer and the government which granting specific subsidies to the farmer if he respects the contract.

This latter includes social and financial aspects as well as environment and landscape aspects.

In terms of coercitive measures, an environmental tax against farmers using too many pesticides and fertilisers is planned.

For example, in 2003, a nitrogen tax will be applied.

This is just the beginning of a set of measures which will be go into effect in the next years.

To apply these measures, we need to assess the impact of agricultural practises on the environment, therefore, an agro-environmental diagnosis method is necessary.

The need for agro-environmental methods is increasing daily. Efforts has been lead to define the content of these methods and the relevance of each diagnosis. Now it becomes necessary to develop some software products allowing a large scale use of the methods.

2. *Use of agro-environmental diagnoses on a large scale*

The common weakness of all agro-environmental software products

Over the last years, many developments have occurred in software allowing environmental diagnoses.

Each method has included specific tool aimed at providing the farmer with indicators. These tools were developed with Excel or with databases like Access.

In all these tools, some information is requested from the farmer; after that, environmental indicators are calculated.

The common point of these tools is that there are used independently. The farm environmental diagnosis produced by these software products is, indeed, not integrated into existing tools or diagnoses.

This lack of integration raises some specific problems in information collection and software developments:

- a specific data entry to collect the necessary information to set up the diagnosis;
- the need for very precise information;
- a considerable time needed to collect data;
- specific procedures to ensure relevance of collected information;
- a minimum level of conceptual knowledge needed to enter relevant information.

Today, if these tools provide a good answer in the drawing up of an environmental diagnosis, they all have a common weakness. They are quite difficult to manipulate at a large scale as collecting information and ensuring its relevance are painstaking tasks.

These tools were well-adapted to the experimental phase but they must now evolve to reach the new objective of 'mass production'.

Solutions for reaching the 'mass production' level

To avoid multiple keying of the same information, one possible solution is to integrate environmental tools into existing information systems.

In 2001, a study lead by the ENITA de Bordeaux (which designs and develop accountancy software products) and SOLAGRO (the non-governmental agency which set up the method SOLAGRO) showed that the environmental method relied on considerable data already stored in an accountancy database.

At farm level, the mineral balance could, for example, be calculated from the amount of fertilisers and pesticides already entered.

It was therefore decided to integrate the environmental diagnosis directly into the accounting software product. To produce an environmental diagnosis, we needed only to complete the accountant database with information specific to the environment.

This avoids multiple keying of information and ensures relevance of information.

One disadvantage of this system is that the farmer is forced to use one unique integrated tool.

In order to avoid forcing the farmer's hand, a second solution in being developed. This consists of the setting up of an 'environmental data warehouse' which would contain all data necessary to produce an environmental diagnosis.

This data warehouse would be defined in relationship with all existing farm information systems such as accountancy, plot management, GIS ... This requires, of course, normalised interfaces.

The latter constitute the greatest problem inherent in this solution.

Positive aspects of such an architecture are:

- the farmer is not dependent on one unique, integrated tool to produce his/her diagnosis;
- this data warehouse could be used at the farm level as well as the collective level (for group analysis for example).

At the present time, the structure of the data warehouse has been defined by the ENITA and Solagro.

The use of the system at a large scale should be initiated at the beginning of 2003.

4.5 Conclusion

As environmental issues are now more and more important in farm activities, management diagnosis methods must take into account an environmental approach. In addition to financial diagnosis method, environmental diagnosis methods have to be developed during the next years.

In the last several years, such methods have been created in France, and some are more and more frequently used at a consequence of the new agricultural policy. This evolution shows clearly that farm managing has now to deal with several aspects outside the farm, related to society and the environment.

For farm managers and policy makers, this evolution means being able to include these dimensions in the farm diagnosis. However, it could also mean years of work in order to obtain relevant diagnosis methods and relevant software products.

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5. FADN data to produce indirect statistics on the use of pesticides and to define the spatial distribution of plant diseases

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Abstract

INEA, inside the TAPAS[1] (Technical Action Plans for Agricultural Statistics) program for the amelioration of agricultural statistics, according to the real needs in term of quality and organisation of statistical data on the use of pesticides, has developed a methodology based on indirect statistics and, using GIS (Geographic Information System) technology, the integration of different data typologies and sources. The GIS is implemented with several cartographic layers (land use, soils, water sources, climate) and is related, thanks to a Relational Data Base Management Systems (RDBMS), to a data base with administrative and statistic data on crop surfaces and data on pesticides requirements of each crop. This methodology allows to develop a system to produce and organise data at geographical level, considering that agri-envoronmental problems are related to specific areas (environmental vulnerability areas), inside specific boundaries, in general river basin.

The production of indirect statistics on the use of pesticides is based on land use data (annual cultivation surfaces) in correlation with Good Agricultural Practice and/or with pesticides national data bank (annual quantity of pesticides per cultivation). The integration of these data with different sources and typologies (industrial production and sales, pesticide costs and uses at farm level, etc.) is essential to correct, calibrate and validate indirect statistics. In particular, FADN data, with the definition and the implementation of a specific questionnaire on pesticides use on a 100 farms (geographically referenced) FADN sample, are strictly required to define the diffusion of plant diseases and the specific dosage per hectare really used by the farmers in each area.

5.1 Introduction

During the last decade, there has been a growing requirement within the European Community for meaningful and accurate statistics on pesticide use. With the development of environmental indicators also moving into the role of pesticides and their impact on the environment, clearly, sound statistical information was required, particularly if the role of policy changes on pesticide use was to be assessed over time.

[1] Following a broad reflection which started at the beginning of the 1990s the Council approved a legal framework (Decision 96/411/EC, the 'TAPAS' Decision) which allows the Commission, in close co-operation with the Member States, to develop and implement, with a Community financial contribution, annual 'technical action plans for the improvement of agricultural statistics'. The TAPAS are defined in close co-operation between the Commission and the Member States within the framework of the Standing Committee for Agricultural Statistics, established by the Council in 1972.

Furthermore, an important target of the European Commission's 5th Environmental Action Programme is the reduction of pesticide risk, and this will be impossible to monitor without sound information on changes in use over time.

Reductions explained only in volume applied are meaningless with regard to risk as many new active substances are applied at much lower rates per hectare than the older products they are replacing, bringing about significant reductions in the weight applied, without necessarily resulting in any reduction of use or risk. From this point of view, the accumulation of sales statistics, and the general trends of reductions in weight used which they frequently show, can be seen to fall a long way short of providing the type of data required to allow meaningful assessment of the impact of policy changes on pesticide use and their consequences for the environment.

The collection of a reliable set of usage statistics has value in many areas of research, legislation and agricultural support, and should not be seen as a simple statistical exercise in its own right. For more details on the subject see annexe 5.3.

The following information related to pesticide use was considered important:

- crop treated;
- area of crop grown;
- product used;
- amount used or rate of application (kg/ha);
- area of crop treated;
- any biological control methods used;
- timing of application.

There are several methods of collection already in use within the European Union and OECD members. Five broad methodologies are available requiring differing levels of input and organisation:

1. personal visits to a representative sample of farmers and growers to collect information on what they have used;
2. telephone interviews with a representative sample of farmers and growers;
3. postal surveys of a representative sample of farmers and growers;
4. compulsory returns of pesticide use from all farmers and growers;
5. alternatives to surveys of usage - collation of sales statistics.

In the last years, thanks to the availability, at EU and national level, of several data base on the information related to the use of pesticides (as listed above) and to a more accessible GIS technologies and data sources, a new methodological approach, based on indirect statistics on the use of pesticides, is going to be developed.

This methodology allows to develop a system to produce and organise data at geographical level, considering that agri-envoronmental problems are related to specific areas (environmental vulnerability areas), inside specific boundaries, in general river basin using GIS (Geographic Information System) technology to integrate different data typologies and sources (cartographic layers, administrative and statistic data, manuals and data on diseases distribution and pesticides requirements of each crop).

The integration of these data with different sources and typologies (industrial production and sales, pesticide costs and uses at farm level, etc.) is essential to correct, calibrate and validate indirect statistics.

In this paper particularly attention is paid on the valorisation of FADN network and data to produce statistics for agri-environmental monitoring. The work shows how is possible to utilise FADN as part of a statistical project, in particular as indicator/basis to establish the average quantities of utilised pesticides at farm level (amount used or rate of application - kg/ha) to produce indirect statistics about the use of pesticides in agriculture, combining different type of data from different sources. In this sense FADN data are extremely important (essential for both diseases distribution and utilised quantities of pesticides data), probably the key element, to produce indirect statistics on the use of pesticides with a territorial approach. FADN could be also useful for defining the area interested by plant diseases (or area of crop treated) and the list of crop treated and product used.

5.2 Methods and activities

Such methodology is based on the following points:
Geographic area of reference: a southern province of Italy (level NUTS III);

Utilised data:

- CASI 3 Land use cartography, has been produced by INEA within the P.O. 'Risorse Idriche' project. CASI 3 is a cartography layer obtained from satellite images interpretation, (Landsat TM), digitising from digital orto photo, on grey tones, of geometric resolution of 1 meter pixel, and with a further extension and improvement of the classification system derived from the CORINE Land Cover legend to the IV level for the irrigated classes. For the irrigated classes the acquisition scale was 1:50.000, while for the other classes (urban, woods, waters) the CORINE scale of 1:100.000 was maintained;
- administrative data about the culture distribution in the province, in particular short-term ISTAT data has been used and aggregated for Agricultural Region, as for that belonging to the same land-use cartography year (1998) and availability data on sales;
- data about the amount of pesticides used per culture, in accordance with the 'Good agricultural practices', and the Pesticides Pathology Institute (ISPaVe) Data Bank;
- data about the quantity of pesticides used by the farms, and spreading of the most important pathologies on the study area. The data has been collected from the RICA farm network through a particular technical survey (enclosure 1);
- regional Pesticides sales data (SIAN);
    - utilisation of GIS technology to perform spatial analysis and data aggregation at geographical level (river basin and/or land unit);
    - results and data analysis.

The work started in September 2001 with the collection of data on land use and on pesticides best practices. The surveys on RICA sample started in June 2002. The final results were obtained in July 2002.

The results refer to the year 2001. The activities carried out to completely meet the methodological approach were:

- realisation of the geo data base on land use and agricultural cultivation distribution in 2001;
- acquisition and elaboration of:
  - national data bank on pesticides: legislation and practical uses (on the base of GAP: Good Agricultural Practice);
  - data on industrial pesticide production and sales (1998-1999, from Agricultural Ministry);
  - data on pesticide uses at farm level (on the basis of a specific questionnaire for FADN sample - 2001);
  - extension services data (2001);
- definition of the methodologies to link the land use data base with the pesticide data base and to correct the data on the average/optimal quantities of pesticides per disease/crop with the 2001 real use (based on a farm sample);
- realisation of models and related software;
- calculation of normalised pesticides use per land use polygon;
- realisation of the pesticides use (normalised) map;
- definition of sub-river basins;
- aggregation of data at river basin and administrative (NUTS IV and V) level;
- calculation of annual pesticides use per land use polygon;
- data validation and correlation with administrative data at NUTS IV level.

Due to economic we used the Italian FADN surveyors network for pesticides questionnaires implementation. The sampling and the survey have therefore been georeferenced. FADN sample was (random) selected on the basis of crop and disease distribution.

5.3 Data and procedures

Area of interest

The area of the province of Chieti in the Abruzzo region is the one that has been selected for the realisation of the TAPAS project. This area is characterised by a particular wide watershed, especially in this province run the rivers: Trigno, Osento, Sangro e Sinello, that form important river basins.

The province total area is about of Ha 258.648,42 which Ha 145,86 of the area has the following land-use represented by classes obtained from Casi 3 cartography (where cultural classes are appositely aggregated for the project object):

Table 5.1 Agricultural distribution of the Chieti Province area

Culture			Hectares
211	-	Cereals (not corn)	62.786
2121	-	Industrial Cultures	2.739
2122	-	Autumn vegetables	1.979
2123	-	Summer vegetables	1.816
221	-	Vine	30.215
223	-	Olive	42.285
222	-	Orchards	3.807

(INEA - cartografia Casi 3).

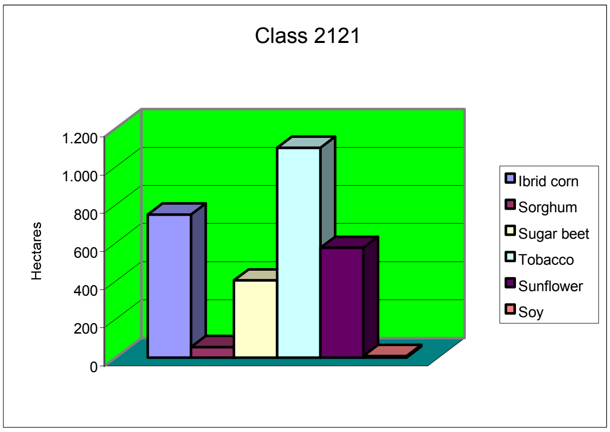
Land use re-interpretation

To estimate statistics about the use of pesticides in agriculture is determinant to know the land use of the study area to such a level that will allow distinguishing the single cultural species.

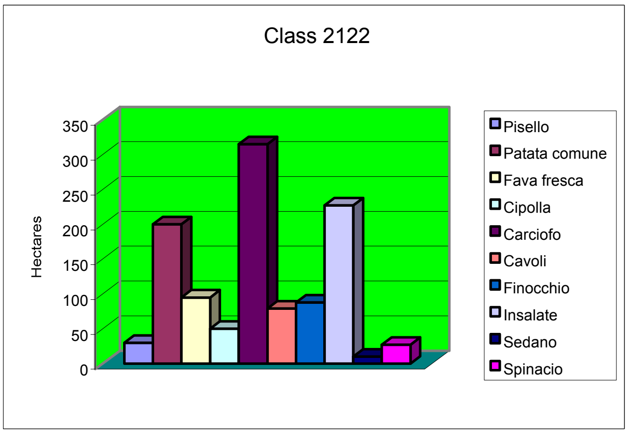
Using CASI 3 cartography the project area has been interpreted to a detailed level that allowed making such distinction.

In order to re-construct the land use a defined procedure has been followed integrating data from different sources (geographic and administrative/land unit) with the following steps:

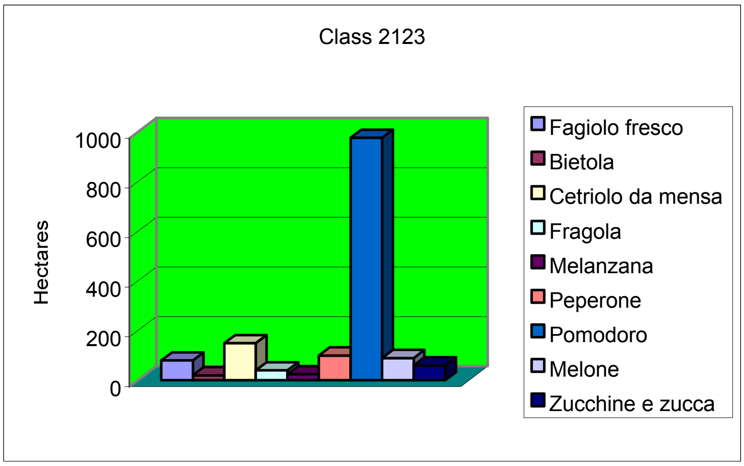
- intersection between CASI 3 land use cartography layer and the Agriculture Regions layer;
- aggregation and definition and sum of the areas according with the CASI 3 classification and short term ISTAT data for single Agriculture Region;
- calibration of the Istat data with the CASI 3 data;
- identification of the possible frequency classes of the different culture growing inside of the single CASI 3 class polygon. (es. a polygon formed by sow able watered land of industrial cultures class 2121, of 30 Ha is made by: 45% corn, 20% sugar beet, 15% sunflower, 10% sorghum = 100%). From this you can get the area of each culture of each Agriculture Region;
- identification of the most representative cultures of the province;
- from the ISTAT data the predominant cultures are the following:



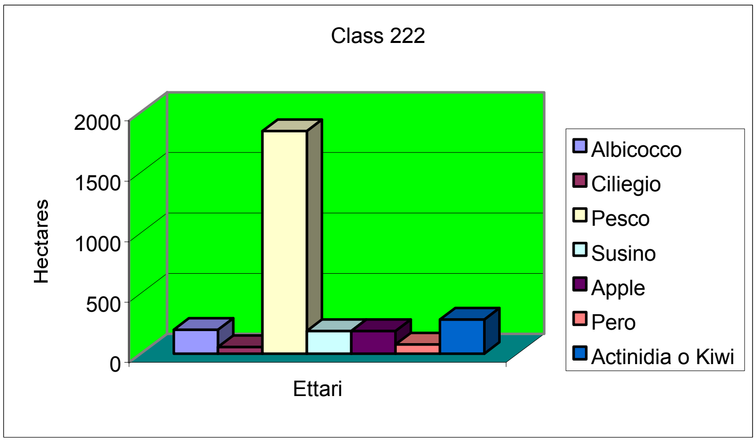
Within the class 211 the most represented culture is wheat 24,650 ha (80.56% of the whole class).
Within the class 2121 the most represented culture is tabacco with 1,100 ha (38.04% of the whole class).



Within class 2122 the most represented culture is artichoke with 315 ha (28.10% for the whole class).



Within the class 2123 the most represented culture is tomato with 978 ha (63.38% of the whole class).



Within the class 222 the most represented culture is peach with 1.846 ha (64.86% of the whole class).

Besides Olive groves and Vineyard cultures are spread respectively for 27.54 and 29.50% of the whole provincial area.

Therefore during data processing such culture has been taken in consideration as well.

Pesticides Data-bank

This data bank has been provided by ISPaVe Institute and has the suggested optimal quantities for each culture, of the different pesticides, to be used depending on the found diseases.

Used quantities on farms and disease diffusion.

Furthermore the ongoing data survey on the FADN farms, research studies has been done with the ARSSA Institute (Plant disease observatory) especially on the diffusion of the diseases. The results are summarised in figure 5.1.

Culture	Pathology (Latin name)								
Vineyards	Perono-spora	Oidio	Botrite						
Olive trees	Mosca delle olive	Occhio di pavone							
Peaches	Bolla del Pesco	Oidio	Cancri rameali	Monilia	Corineo	Cidia	Anarsia	Coccini-glia bianca	Afide Tripidi-verde
Tomatoes p.c.	Perono-spora	Botritis	Alterna-riosi	Oidio					
Tomatoes c.p.	Perono-spora	Botritis	cladospo-riosi	Alterna-riosi	Oidio				
Tobacco	Perono-spora	Pulce							
Cereals	Oidio	Ruggini							

Figure 5.1 Main deseases on FADN sample
Source: ARSSA - OMP 'Technical guidelines for plant protection', reg. Cee 2078/92.

5.4 Data analysis

The data analysis steps (see pic enclosure 2), has been done through these phases:

- geographic intersection between the Agricultural region and the CASI 3 Land use layers, to obtain a resulting a vector layer where Land codes each polygon. Aggregation of the Land use data by A.R.;
- ISTAT data calibration aggregated by A.R., with CASI 3 land use data, with specification for each polygon of the possible frequency classes, of the different cultures. Pesticides mapping of the most spread diseases in the regional area using the following procedure:
    - using the RICA farms data survey sample a vector point layer has been created divided in and two categories: vineyard-Olive grove farms and Fruit tree- arable land farms;
    - each of these farms has been coded regarding the found disease during the farm survey, following the code number table illustrated below;

P1 = Plasmopora viticola (vite)
P2 = Uncicola Necator(vite)
P3 = Lobesia Botrana(vite)
P4 = Dacus oleae (olivo)
P5 = Micosi varie(olivo)
P6 = Infestanti Vite + Olivo
P6 = Infestanti Vite + Olivo
P7 = Micosi varie(Orchard)
P8 = Insetti vari (Orchard)
P9 = Infestanti (Orchard)
P10 = Micosi varie(Arable land)
P11 = Insetti vari (Arable land)
P12 = Infestanti (Arable land)

- at this point from a linear interpolation process, 12 different layers have been created (in GRID format with a 100 mt resolution) for each code number;
- the obtained layers have been synthesised into two final grid layers (one for the olive grove and vineyard -code P1, P6 and the other one for the disease distribution for Orchard and Arable land disease distribution code P7, P12);
- the Grid layer has been converted into a vector layer, which has been intersected with the land use cover, thus obtaining for each polygon the information about the different type of disease found;
- using the surveyed farms data about the pesticides quantities used on the farms and those from best practices data (ISPAVE) a JOIN table has been created which has been linked with Land use-disease diffusion vector layer table, getting in this way the average quantity used for each polygon;
- calculating and dividing alphanumeric data regarding the Fungicide, Insecticide and Herbicide total quantities in two categories:
  - data obtained from the farms data survey;
  - data obtained from the best practices data.

The difference between the two sets of data has been calculated.

Furthermore the Land use/disease diffusion vector layer has been intersected with the river basin layer to get the total quantities of pesticide used for river basin.

5.5 Results and conclusions

The achieved goals are both geographic and statistics.

The geographic part is made by the following data:

- cartography representing plant diseases distribution (on the basis of FADN surveys);
- cartography representing quantities calculated for each polygon based on ISPaVe data (quantity suggested);
- cartography representing quantities calculated for each polygon based on FADN data (quantity used on farm);
- cartography representing the differences between the two above;
- data aggregation for river basin of the area (obtained from Digital Terrain Model analysis in Arc Info environment).

The statistic part is made by the following data reports:

- pesticides quantities for the main categories calculated at NUTS III and river basin level;
- definition of correction factor between agricultural best practices quantities and pesticides real use at farm level (main problem for indirect statistics);
- comparison with data on sales at NUTS III level, to test the possibilities to use administrative data.

Table 5.2 Summary and comparison on the used quantities of pesticides

Pesticide typologies	Year 2001	
	recommended/ optimal quantities Qls	real quantities used by farms (FADN) Qls
Insecticide	276.26	437.66
Fungicide	3.262.65	4.872.39
Herbicide	229.48	230.17

In developing the indirect statistics methodology, the greatest problem was the lack of data on diseases distribution. This data is essential to produce indirect statistics on the basis of pesticides recommended quantities of Good Agricultural Practice and/or pesticides national data bank. This because, otherwise, we should consider as always existing each possible disease of the crops present in one area (NUTS III or river basin). In this sense FADN data are essential for both diseases distribution and utilised quantities of pesticides data. Having FADN available data on the real use of pesticides could be the key element to use an indirect statistics methodology on the use of pesticides with a good costs-benefits ratio. Therefore is strongly recommended to implement data surveys with the implementation of a questionnaire on the use of pesticides.

In conclusion:

- FADN could allow to produce indirect statistics on the use of pesticides, as well as other agri-environment aspects, integrating different data sources (GIS), with a good cost benefit ratio and accuracy;
- FADN data are strictly required to define the diffusion of plant diseases and the specific dosage per hectare really used by the farmers in each area;
- on the basis of the actual data set, is still not possibly to define automatic procedures in the realisation of indirect statistics on the use of pesticides;
- as in mostly IDSS, the filter and the interpretation of data from a thematic senior specialist, supported by orthophotos, satellite image and ancillary data, is strongly recommended.

Considering the good results of the project and the significance of the differences between the recommended and the really used quantities of pesticides, the experimentation of this methodology on more test areas (at NUTS III level) in several EU countries, with a huge utilisation of FADN data and with the definition of a correlation factor between utilised and optimal quantities is strongly recommended.

Annexes

Project flow chart

Cartography
Base data map
Processing data map
Role of Usage Statistics on Pesticides
Use of pesticides per river basins in Chieti Province
Example of FADN pesticides questionnaire

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Annex 1 Role of Usage Statistics on Pesticides

In their simplest form, usage statistics provide information on national and regional levels of pesticide inputs to individual crops. Thus the total amount of any one pesticide used annually should be available, together with the areas treated and the range of crops to which it has been applied. Additionally, information on the total inputs of all pesticides to any one crop would also be available. Both these may be broken down to provide a seasonal profile of use, as dates of application should also be available. Such data are required at several levels.

Usage data are critical for the development of indicators of the effects of pesticides on the environment, and data sets over time are required in order to monitor the effects that policy changes may have on that impact. Programmes within the EU (Sectoral Infrastructure Projects in the Context of Environmental Indicators and Green Accounting) and OECD (Pesticide Forum: Pesticide Risk Reduction Project) are acutely aware of the necessity for sound usage data over time in order to fully develop such indicators.

Once the collection of a regular set of usage statistics has been established, changes over time in use on particular crops, or of particular pesticides, can be monitored. These may result from several factors, some or all of which may interact to give annual variations in use.

Data on pesticide usage can be used to assist in the monitoring of pesticide contamination in surface and ground waters. Fro example, the EU aims to protect drinking water and groundwater through legislation, leading to widespread monitoring of pesticide residues in order to comply with these directives. Within Great Britain, usage data are used within a complex geographical information system, containing maps of soil and groundwater, rivers and other waterways and water abstraction points. This is overlaid with current cropping and pesticide usage patterns, both geographically and seasonally, and, together with a database of pesticide properties and models of movement through different soils, is used to predict the likely appearance of pesticides at abstraction points to facilitate the monitoring of pesticides in water. By so doing, it is hoped to avoid unnecessary monitoring for pesticides which are unlikely to appear at a specific point or time within a given water body. It is important to note, however, that such methods can only be used to direct monitoring rather than substitute for it.

Data on farmers' actual use of pesticides may be examined to see their current practices may be improved or optimised. For example, within Great Britain, the comprehensive database of farmer practice with regard to fungicide and insecticide use on winter wheat is being examined to identify where farmers may be using pesticide programmes inappropriately. This is being examined particularly with regard to under-utilising varietal resistance or inappropriately timed pesticide applications. Furthermore, there would appear to be some scope for reducing pesticide applications under certain circumstances. It is hoped that areas where clear savings can be made will be identified and targeted for further advice, in an effort to reduce inputs of pesticides to those crops. The technique should be applicable to many crops.

Annex 2 Use of pesticides per river basins in Chieti Province

River basin name	FADN data - total pesticides (A) Kg/Quintals	Best practices data - total pesticides (B) Kg/Quintals	Difference between data (A - B) Kg/Quintals
Alento	210,551.95	138,700.83	71,851.12
Arielli	2,034,517.20	1,303,495.24	731,021.96
Feltrino	1,041,390.28	668,790.39	372,599.89
Foro	430,702.16	276,222.54	154,479.62
Moro	2,171,733.96	1,394,009.48	777,724.48
Osento	84,784.11	72,074.76	12,709.35
Sangro	110,894.65	91,413.50	19,481.15
Sinello	131,740.55	111,774.33	19,966.22
Trigno	47,501.37	30,688.31	16,813.06
ZL tra Moro e Feltrino	1,345.65	1,339.47	6.18
ZL tra Sangro e Osento	12,378.74	10,938.34	1,440.40
ZL tra Sinello e Trigno	45,554.00	36,946.81	8,607.19
ZL tra Arielli e Moro	286,939.82	183,829.29	103,110.53
ZL tra Feltrino e Sangro	21,497.92	15,435.18	6,062.74
ZL tra Osento e Sinello	85,508.59	56,809.12	28,699.47
TOTAL BASINS (Kg)	6,717,040.95	4,392,467.59	2,324,573.36
TOTAL BASINS (Ql)	67,170.41	43,924.68	23,245.73

6. Regional Integrated Model Using FADN AIAX Data Bank - AGEA

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Abstract

The aim of this paper is to describe the principle characteristics of a model that has the objective of estimate the effects of the agricultural polices measures at sub-regional, regional and national level. This model is based on the utilisation of 'positive' information contained in two different databases as FADN and AGEA (Italian administrative database), and a methodological instrument as PMP (Positive Mathematical Programming) to reproduce and properly simulate the entrepreneurs behaviour in their territories.

The objective of the model is to overcome some limits which derive form the separate use of accounting database and administrative ones, valorising the potentialities of the PMP in estimating and reproducing the cost function for each firm typologies in every single region, obtaining an instrument of agricultural policy at the same time flexible and complete.

An application of the proposed model will be presented analysing the introduction of the MTR in Veneto Region.

6.1 Presentation of the model

The agricultural policies that had the major impact on the productive organization at farm level of these last years, have been characterised by the adoption of measures sustaining farmers income in the shape of direct payments to farmers in a coupled and decoupled form. These payments, from one hand have the aim of reducing, to the farmers themselves, the cost of an increasing liberalisation of agricultural world markets, and on the other hand, they try to support the spread of different agricultural practises, suitable to the needs of the modern society (for example the *cross compliance* measures).

However, the policy tools of agricultural polices for sustaining income, as those until now used, seemed sometimes not very efficient towards the needs and the objectives for which were created. For this reason, a priori evaluation, by of suitable models, of the possible effects which these tools would have developed, represent a necessary step in the definitive way of definition of the future effective instruments of agricultural policies.

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Parts 1, 2 and section 4.2 are written by Michele Donati, part 3 and sections 4.1, 4.3, 4.4 by Marco Zuppiroli, while part 5 is written by Filippo Arfini.
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In relation to the objective of evaluate the effect of the policies by means the use of models, the analysis at a firm typology level doesn't create particular difficulties, but the analysis at regional and national level, that consider also the characteristics of the firms, oblige the researchers to face problems more complex. In fact, in order to reach the objective to develop models able to analyse the productive organisation and market aspect on regional and national scale, it's necessary to have information able to describe the behaviour of different typologies of agricultural producers in their territories and suitable methodologies both for the data management and economical representation of the entrepreneurial behaviour.

The aim of this paper is to describe the principle characteristics of a model that has the objective of estimate the effects of the agricultural polices measures at sub-regional, regional and national level. This model is based on the utilisation of 'positive' information contained in two different databases as FADN and AGEA (Italian administrative database), and a methodological instrument as PMP (Positive Mathematical Programming) to reproduce and properly simulate the entrepreneurs behaviour in their territories.

The objective of the model is to overcome some limits which derive from the separate use of accounting database and administrative ones, valorising the potentialities of the PMP in estimating and reproducing the cost function for each firm typologies in every single region, obtaining an instrument of agricultural policy at the same time flexible and complete. This approach also reduce the problem of statistical inference due to sample FADN, that are not always statistically representative of the productive activities of a certain sub-region.

On the contrary, the administrative databases, represents the productive characteristics of the universe of the firms really present on the market and that more interact with agricultural policies, because they are the farms that receive direct payments.

Concretely, the construction of a regional and national model of agricultural policy is organised in a succession of phases which required the combined uses of algorithms, used for the input data management, and the specific software programme, which translates the theoretical PMP model into the computer language (in this case GAMS). The phase of data management is articulated into successive sub phases such as: a) the extraction of the data from databases; b) the control of the data quality; c) the organisation of a new joined database; d) the organisation of the input data in an adequate form for the PMP software model. On the contrary, the PMP theoretical model, follows the Howit and Paris (1998) approach in order to estimate, at first, an aggregated cost function, from 10 firms typologies, localised inside every sub-region and, in a second time, calibrate every single sub-regional models.

The phase of evaluation of agricultural policy is made by gathering together every sub-regional models, already calibrated, in a single regional, or national, model where the objective function is the sum of the objective function of every single sub-region and linked to the correspondent sub-regional technical matrices. The maximisation process of the aggregated objective function allows to obtain a solution that is 'optimal' for the entire model, but for every sub-region it is also a 'local optimal solution'.

The phases that we have to face in the construction of the model are:

1. management input. In this phase two different data bank and a specific software were used;

2. the calibration of the starting situation at sub regional level: the reproduction of the starting productive levels by means of PMP procedure;
3. the phase of the model aggregation, calibrated in a single regional or national model;
4. the second calibration phase: in this phase the new model is calibrated at regional or national level;
5. the phase of simulation of the scenarios of the policy at regional or national level;
6. the analisys of the resuls.

6.2 Input data management: The integration of the data bank AGEA and RICA

6.2.1 Why we need merge FADN with AGEA ?

The possibility to integrate two data banks that they have functions, objectives, modality of survey of the various data and territorial representativity very different between them, let us to exceed some limits that both the data banks present, making the most of the information. In particular, between the limits it is necessary to remember that the FADN doesn't represent properly land allocation at farm level, while AGEA gives us the exact picture of the land use for each farm that apply for EC financial support. The possibility to know precisely the modalities of the soil use represents a remarkable advantage in relation to politics relation that foresees aids of type partially decoupled concurring to directly tie the production processes to the measures of agrarian politics. On the contrary, FADN gives us information about price, yields and cost (in Italy) for Farm Typology and the Policy Maker required to predict the effects of new policies in agricultures at Regional and FT level (for farm size or economic size), concurring in this way of modelising precisely the economical and typologies of a certain region and sub-region.

For these reasons the data that are used put together the information of Given Administrative Bank (AGEA) and FADN (Italy) for the same year (Year 2000).

More in detail, we utilise the 'best' information from both:

- from AGEA: the use of the land in detail are the expression of the farmer strategy;
- AGEA Data assure a full representation of the 'cereal and oil-seeds' farms. For those farms it is possible reconstruct in detail the structure of the land use at level of Farm Typology and Municipality;
- from FADN: Technical and Economic data for each activity that are impossible to find in any other data bank;
- FADN is the only source able to provide technical and economic information on the farm activity.

Concerning the representativity of the AGEA data, the comparison with the Italian Census (Anno 2000) let us to verify for Arable crops if there is a full representativity of the real situation.

6.2.2 Input data generation

The predisposition of the matrices of input of the data of the model is one of the most critics of the modellisation, because is on the quality of the data that the quality of the final results depends. For this reason the use of the Informetion Tecnology (IT) by means of developed software, gives a remarkable elasticity to the instrument in the phase of selection of the territorial data, allowing the introduction of procedures of qualitative analysis and the optimization of the times of work.

In the case of the construction of the models object of the work, it has been developed a series of successive algorithm generating a procedure called 'Positive Mathematical Programming Input Procedures' (called PIP1) which has the objective to arrange the information deriving from the two data banks so as to gain the being followed necessary information for the implementation of the PMP model:

1. firm soil destined to sold production;
2. soil business destined to productions re-used inside the firm;
3. production destined to the sale;
4. destined productions to the re-use;
5. costs of the sold;
6. costs of the re-used one;
7. prices of the sold;
8. compensations of the sold processes;
9. compensations of the processes re-used;
10. zootechnical heads raise;
11. zootechnical productions;
12. costs of the zootechnical processes;
13. prices of the zootechnical processes;
14. compensations of the zootechnical processes.

The program PIP1 before computing the technical and economical coefficients it proceeds to a checking of the anomalous values in the data bank FADN, so as to eliminate those values that could influence the averages.

In schematic way, the stages in which the PIP1 is articulated are the following:

1. loading of elementary data AGEA;
2. loading of data FADN of the Rica mini-bank;
3. control of the eventual anomalous values and their correction;
4. selection of the territorial area on which carrying out the analysis: in this case two types of area are selected, one of reference and the other of interest;
5. selection of the business classes on which to construct the models;
6. calculation of technical coefficients FADN to support the data bank AGEA;
7. determination of the surface AGEA for each of the selected classes;
8. combination of technical coefficients FADN with the AGEA surfaces for the determination of the necessary matrices to the elaborations of the model;
9. generation of the matrices of the variable for the selected area and the defined business classes.

The matrices of output of the PIP1 are printed publication on format single text, in the format requested from GAMS for the reading of the data.

6.3 Phase of calibration of the Baseline to on-regional level

The input data, organised in matrices, are used directly in the model of PMP developed directly using software GAMS. In this phase of application of the model of PMP is carried out only the single calibration of the model in order to verify the correctness of the estimation both considering the use of the soil and the costs it estimated at sub-regional level. This phase, called calibration, in its theoretical and methodological formulation, follows 'the classic' formulation of Howitt and Paris (1998) that brings to the estimation of non-linear cost function represented by the Matrix Q. Operativelly, the sequence of the algorithms adopted in this phase requires:

1. calibration of the initial productive levels by means of a linear model with calibration constraints;
2. estimation of a non-linear cost function by means of the method of the maximum entropy;
3. print on file of the necessary information for construction of an aggregate regional model.

Last stage of this first phase regards the print on file of the necessary information for the successive phase of aggregation. In fact, the scope of this model is to collect information on the initial state of every company of the 'frontier' represented by the sub-region in order to be able later to recover the phase of aggregation of the model. In this way it is possible to construct to a single model of prediction for all the sub-regions (calibrated) of a certain area of interest.

The information conserved for every sub-region are:

1. prices;
2. matrix of the costs;
3. technical coefficients;
4. compensations;
5. factors of the production.

For each of these information, a file in the GAMS format is generated.

6.4 Phase of aggregation of the models calibrated in an single regional or national model

6.4.1 Aggregation

The phase of aggregation of the information has an important role, because all the parameters that exit from the calibration of the models sub-regional are recovered and inserted as parameters at macro-area (region, agrarian zone, etc.) level so as the simulation model can deal the information coming from the different models in a simultaneous way.

6.4.2 Structure of the regional model and phase of calibration

The reconstructed information therefore are used by the non-linear model in order to reproduce the initial productive situation, making less of ties than calibration. Synthetically, the function of cost introduces in the objective function of the PMP model incorporates the dual values of calibration ties, leads the solution of the model towards the productive levels observes to you in the departure year, without having to use the positivity ties on the productive capacity of the firms.

The objective of this new model, is the objective maximisation of one function more general represented from the sum of the single business functions of profit:

(1) **Error! Objects cannot be created from editing field codes.**

where, *PROFT*represents the total profit at the regional level. The maximisation of the objective function, is subordinated to one series of ties linked to the firm structure and the agricultural politics. Above all, the structural tie on the available resources (earth) can be written in the following way:

(2) **Error! Objects cannot be created from editing field codes.**

The tie (2) requires that all the earth used for the sold and re-used production and the set-aside, is at most equal to the total availability of earth at firm (bn). In (2) it appears the variable one shs, soil to set-aside, that it is present also in the following tie, relative to the business set-aside:

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where **Error! Objects cannot be created from editing field codes.** represents the set-side coefficient of the firm n that multiplies the soil destined to arable seeds and to set aside. In short, this tie determines the soil to set-aside of the firm n. The set aside rate varies between the companies because the smaller companies are esonerate from the set aside tie. Beyond to the structural earth tie available, there's another tie that defines one relation between the zootechnical activities and the firm surface. This tie defined like

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links the needs and the disposability of products at firm level.

In this way, maximising the total income, the firm profit is maximised implicitily $PROF^n$ obtaining an optimal solution at regional level but even optimal at sub-regional level.

This procedure let to put inside the regional-national model even that ties that act at regional-national level , maintaining all the information at sub-regional level.

6.4.3 Phase of simulation of the scenes of politics at regional or national level

The political scenarios that can be analised with the proposed methodology are multiple and in particular, they are referred to the recent proposal of reform of the PAC contained in the document of MTR of the European Commission, in which the necessity is put in evidence to take part in the agricultural field with aids:

a. decoupled;
b. modulated.

The construction of the simulations is constituted in the formulation of scenarios that could estimate the two measures in disjointed way and, later on, jointly. The scenarios are three:

1. Aids decoupled to the business productions;
2. Aids modulated for the firms outside the exemption with compensations coupled to the productions;
3. Aids modulated and decoupled.

The scenarios of the aids decoupled is defined sharing on all the firms productions the total level of aids perceived from the firm processes based on different OCM (seeds, olive trees, milk) considering the new level of the unitary aids foreseen by the proposal of the Commission.

The introduction of the modulation scenario has requested the predisposition of a new tie of the model in order to hold account of the curtailment endured by the companies with a level of compensation advanced total to the 5,000 euros/firm.

6.4.4 Result of the simulations

Once made the relative elaborations to several scenarios included in the simulation model, the results are save in three files containing the relative data:

- of the single companies of the single areas;
- to the business typologies in exemption and outside exemption in the region;
- to the aggregate regional total. The information contained in the rows of output:
- prices;
- productions;
- uses of the surfaces;
- heads raised;
- sold PLV;
- gross and clean compensations (without resources dained by modulation);
- costs;
- gross margin;
- resources drained by means of modulation;
- shadow prices relative to some of ties of the model;

- total cultivated surface.

The files, saved in text format, can be opened by normal electronic sheets (Excel) so as to facilitate the reading and the interpretation.

6.5 Policy analysis

6.5.1 Scenarios object of evaluation

The following analysis is aimed to estimate by means of the proposed methodology the main innovations of the Common Agricultural Policy: the Medium Term Review (= MTR) of Agenda 2000.

First part of the study estimates the impact of the changes that the MTR means to bring to agricultural politics of the UE with particular reference to the production of the seeds in Veneto region. In particular our attention has been concentrated on the scenario that introduces the dynamics modulation and the decoupling. These two instruments of politics are not two indivisible instruments. Indeed, it's possible to modulate the participations without to proceed necessarily to a decoupling of the aids (complete or partial).

This eventuality creates two fundamental scenarios for the analysis of the impact of the MTR on agriculture:

- option M: 'introduction of the modifications proposed for the OCM seeds and the application only of the modulation';
- option MD: option M + 'decoupling'.

Integrating the two options indicated with others two scenarios useful in order to interpret the result of the elaborations:

- option OCM: 'introduction in Agenda 2000 only of the modifications proposed for the OCM seeds';
- D option: 'introduction of the modifications proposed for the OCM seeds and application only of the decoupled of the aids'.

The OCM scenarios is the first to compare with the initial situation on which the model is calibrated; in order to evaluate the impact of the decoupling the results of the scenario D will be compared with those of scenario OCM: an eventual comparison between D and the initial situation make evident the induced changed by the decoupling, but at the gross of the effect of the modifications brought to the OCM seeds. The same considerations are important, mutatis mutandis, in order to measure the impact of the modulation by means of the gained results from the M scenario.

If also every option could differ ulteriorly according to scenarios of selling prices (or of costs) it was preferred not to introduce ulterior agents of change for being able to clearly estimate the effect of the new politics.

In order to take in count the contingentament of the production in the case of the sugar and the milk production, a superficial tie to the expansion of the soil destined to sugar beet has been introduced and to feeding that they cannot exceed of 5% the beginning levels.

The introduction of this tie takes in count the fact that the sugar production and the milk (natural destination of the feeding production), however not increasing on national scale, at least in part, can be distributed inside the national territory according to the changed economic conveniences.

6.5.2 Level of the payments for hectare

The aids for the seeds used to represent the departure situation are relative to 1999. At that time, as today, the amounts were differentiated according to the provincial agrarian area: the values adopted correspond therefore to the amounts foreseen from the plan of regionalization for the elementary agrarian zones.

In the case of the scenarios referred to the MTR, the amounts that have been assumed like references they take in count the modifications that the Commission has proposed for the OCM seeds. In the case of the scenarios that foreseen only the modulation of the amounts are payments to hectare, still coupled, to be subjected only to the percentage reduction (equal to 20%) applied on the exceeding part the exemption.

For the scenarios with modulation and decoupling of the amounts, in general, they cannot be more referred to the single cultivations, the only exception is represented from the aids that would be maintained coupled, they represents the 'premium quality', for the durum wheat, and the specific aids for the proteic plants and the rice [1].

The decoupled payment is included in the model of simulation as a medium value calculated dividing the total of the direct aids that would corresponded decoupled for the number of the hectares of UAA. For every hectare of UAA it comes therefore indicated an equal payment except the processes that, receiving also coupled aids, adds them to the common.

The regimen of still enforced participation does not foreseen differences in the aid for soil unit if these are destined to the same cultivation (as long as within the same agrarian area). On the contrary, the new regimen proposed by the MTR it would eliminate great part of the discrimination between the processes in the same firm, but it would concurr differences between the companies also in the case belong to the same agrarian zone.

[1] In these cases they would come maintained the payments coupled in order to avoid that the offer of these products can go down under a certain level.

6.5.3 Productive and economical result for the Veneto region by the application of the measures proposed with the MTR

6.5.3.1 The changes attended in the use of the ground

Before concentrating the attention on true results it's useful to premise a general consideration concernign the scenarios for the firms with AT lower or equal to the exemption. The firms that enter in this typology subordinated not to four but only to two scenarios and that is: maintenance of coupled payments (that it introduces the same results in the case of the OCM scenario and for that of modulation, concernign companies not subject to the reduction of 20%) and decoupling.

Proceeding now to consider the resuls of the simulations, it can be found, in a generalized manner, that:

- the situation begins them corresponds to that one existing in year 1999: an important part of the changements introduced from OCM scenarios are not due only to the modifications previewed from the MTR for the OCM seeds, but also to the participations already introduced in the first two years of Agenda 2000;
- the variations attended in correspondence of the scenarios that foreseen the decoupled are important and clearly advanced to those previewed in the case of the only modulation;
- the two scenarios that contemplate the decoupling practically supply indications coinciding as far as the changes of the productive ordering. Under this profile the impact of the corresponsion of a single payment prevails; the modulation previewed from scenario DM affects only to the economic aspect of the firm conduction reducing the total gross margin.

The OCM scenario (Tab. 1) previews, during the time, a continuation of dynamics already manifested during the last decade. In synthesis, introducing the modifications proposed from the MTR for the OCM seeds on the system of Agenda 2000, we can wait an ulterior increase for great part of the cereals: the maize, even if increasing less, in percentage terms, regarding rice and barley, would succeed in increasing its invested surface of 9,400 ha (regarding the levels of 1999). These 9,400 ha constitute the 2/3 of the total increment of the cereals on regional scale.

Inside the sector of seeds only for oil seeds the perspective of an ulterior reorganization in all the territories is confirmed.

The introduction of the dynamics modulation, maintaining aids of nature 'coupled' (scenario M), modifies a little the productive order of the Veneto region. Approximately 2,000 ha of cereals and others 1,000 of soya would come transferred to the destined foddering productions to the sale. The total address would not change radically, but the expansive trend of the cereals would be arrested.

Passing from coupled scenarios to a non coupling, the sector of the cereals would endure a decrement of 13,000 ha previously cultivated in maize and common wheat; to this decrease of 13,000 it would be come to add an ulterior reorganization of soia (the -3,500 ha). Part of the free surface therefore would replaced inside the sector of the Arable crop and the proteic plants, the durum wheat, the barley and the other smaller cereals are the most important beneficiaries. The greater part of the surface would come however absorbed from other production processes: in a decoupled context, the model in the first place privileges the cultivation of foddering and the sugar beet.

The transfer of soil to the beet and to the foddering destined to the firm re-use (zootechny) is low for ties set up by the model to the expansion of these processes that, therefore, not being able to cover all the soil freight from maize, common wheat and soya, leave space and possibility to expand themselves fodder destined to the sale.

The evolutions of the two scenarios M and D testify that, in spite of the modulation, the maintenance of coupled couples continues to make to prefer the productive addresses existing before. The protecting umbrella represented by the coupled payments to COP assures that these cultivations do not endure the competition of the beet and fodders.

If instead the decoupling joins to the modulation also the relative conveniences and the reactivity of the various production processes they modify considerably. The sale of fodders becomes attractive and also the sugar beet increases, if also without exausting the entire expansive potential that the model concurrs. The introduction of the decoupling seems therefore able to subverting the favorite orderings from the reform Mc Sharry and from the first three years of Agenda 2000. The levelling of the aid make inesitent the competitiveness induced by the differentiates of preesistenti aids evaluing the real conveniences of market without however highlights a meaningful impact of the prexistent aids that the MTR proposes to maintain or to introduce ex-novo (hard grain, proteic plants and rice).

6.5.3.2 Dynamics of the breedings

The indications that the model supplies for the entity of the breedings are partial because they are only referred to the patrimony quota present inside the firms that have introduced the request for aid previewed from the OCM seeds. However this limitation some lines of tendency can be deduced:

- the modifications to the OCM seeds would have to provoke a contraction, however very small, of the consistency of the meat bovines and milk cows;
- the dynamic modulation, without decoupling, would have to compensate the foreseen negative impact for OCM scenario, making the venet zootechny able to recover the present dimension in 1999;
- the decoupling, when the reference to the cattle for the corresponsion of the aids gets lost, becomes a much more penalizing scenario for the venet zootechny.

It is meaningful that the result of the matching of the decoupling and the modulation would be a reduction of the patrimony lower than that consequent to the application of the only decoupling: the reduction of the aids introduced from the modulation attenuates the convenience differential that penalizes the breeding of the cattle in a decoupling scenario.

6.5.3.3 Evolution of the economic variables

The modification of the OCM seeds can generate a positive effect on the economic result of the companies (measured by the gross margin): in practical the increase of the corresponded aids increment of the business gross incomes is translated in an equivalent. The application of prefigured Agenda 2000 from the MTR previews however that it will be introduced the modulation or the decoupled or both. While the decoupling does not affect the incomes equilibriums already existing, it is obvious to wait a penalization of firm results in correspondence of the modulation. The companies subjected to reduction of 20% of the exceeding aids the exemption would have to endure one contraction of the equal gross margin to -6%.

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Workgroup Session II: The EoI and Environmental issues and other policy changes / project deliverables

Task: Review the list of 5 - 7 potential projects in the working package from the previous session, and add additional projects if needed. Write the project deliverables (outputs) for each of these projects on a flipchart and a blank sheet for presentation.

Group A

Working Package:	Using new ICT opportunities to improve efficiency of current FADN systems.
Instruction on the task:	try to add projects in which new ICT opportunities are explored for FADNs on new policy topics, and then add deliverables.

Group B

Working Package:	Changing information requirements in FADNs as policy issues change.
Instruction on the task:	try to add projects in which data needs from changing policies are gathered and then add deliverables.

Group C

Working Package:	Sharing data between different stakeholders like the regional, national and EU level, with effects on harmonising and conversion and a reduction in the administrative burden.
Instruction on the task:	try to add projects in which data exchange is supported on new policy issues and then add deliverables.

Group D

Working Package:	Using improved data by better modelling for even better information products for farmers and policy makers.
Instruction on the task:	try to add projects in which new products for farmers or policy makers are created on new policy issues and then add deliverables.

Group E

Working Package:	Platform to bring professionals together to learn from each other, especially between old, new and potential EU members as well as with trading partners like the USA.
Instruction on the task:	try to add projects in which experiences on new data needs for changing policies are shared between countries and add deliverables.

Groups for the workgroup session
'The EoI and Environmental issues and other policy changes / project deliverables'

Group A - Using new ICT opportunities to improve efficiency of current FADN systems
G. Bonati (chairperson and reporter)
M. Lekesova
G. Lech
A. Varendi
P. Nino
A. Povellato

Group B - Changing information requirements in FADNs as policy issues change
K. Boone (chairperson)
V. Bratka (reporter)
C. San Juan
I. Martini
A. de Cicco

Groep C - Sharing data between different stakeholders
H. Vrolijk (chairperson)
M. Aamisepp
A. Szelagowska
U. Toic (reporter)
T. Borbas

Group D - Using improved data by better modelling for better information products
F. Arfini (chairperson and reporter)
A. Kinsella
Z. Kubikova
M. Merlo
P. Doria
A. Zezza

Group E - Platform to bring professionals together to learn from each other
B. Meier (chairperson)
A. Karlsson (reporter)
B. Del'homme
S. Schiavon
A. Fais
C. Gundersen

A. Use ICT-opportunities to improve efficiency

1. Handcomputer: incorporate farmers database

   Deliverable: software
   Stakeholders: farmers, datacollectors, financers

2. Feasability study for data integration (IASC, FADN - Animal, etc.) bankinvoices with XML

   Deliverable: report, prototype
   Stakeholders: farmers, datacollectors, users

3. Portal information to farmers:
   - Input FADN data
   - Decision support system
   - Help to apply for grants

   Deliverable: website

4. GPS location of farms

   Deliverable: prototype, report

5. Videoconferences on data input and distance learning

B Changing information requirements as policychange

1. How to manage and integrate already existing environmental data (water irrigation system: water use in different regions)

2. Investigate the possibilities to collect new data

3. Comparison of data on pesticide use (Holland) with indirect statistics

   Deliverable: report with costs and benefits indirect methods

4. Investigate the possibilities to connect data from FADN and IACS – landscape

5. New data: farm location and land use integrated with geographic data.

6. New agricultural activities

   Deliverable: data in database

7. Qualityproducts

   Deliverable: report on experiment for Italy

   Stakeholders:
   farmers, government, local government, EU policymakers, researchers, consumers

C Sharing data between different stakeholders

Find projects in which data exchange is supported by new ICT opportunities

1. To exploit internet possibilities: To have 1 portal to enter all different 'agridatabases'
   To have 1 common shared platforum

   Deliverbles: data entry method and access to data

2. ICT diffusion: To stimulate farmers to provide new data
   To stimulate institutions to provide back information

3. Data warehouse: find yourself data: GIS, FADN, Agr.stat, EU-level, regional level, etc.

4. Decision making support system: To provide information to farmers, policy makers
   Need of data models

5. Bridge databases: common destination

6. Build an 'intelligence system' to enter data, to check data, to speed up the use of database

   Stakeholders: researchers, policymakers

D Using improved data for improved modelling and products

1. Timely information for farm management
   - Cost
   - Fiscal aspect
   - Prediction

   Deliverable: farmdata warehouse

2. Managing risk using FADN: software tools

   Deliverable: impact analyses

3. Off farm activities : cash flow forecast

   Deliverable: farm data warehouse

4. Improve planning at regional level: GIS, FADN

5. Auditing a regional level using a combination with FADN and ICT

6. Accurancy quality data with intelligence system

   Stakeholders: farmers, policymakers

E Platform to bring professions together

Build website: www.experts.org - forum / newsgroup
- database

PROJECTS

1. Content management

   Deliverable: website

2. Website management - how to make it work?

   Deliverable: multidisciplinary

   Stakeholders: farmers, university and research centers, policy makers

7. Building models with FADN data: an application of interactive group modeling

dr. Hans C.J. Vrolijk, ir. Foppe Bouma and dr. Wietse Dol, LEI, The Netherlands

Abstract

Models are useful tools in research and policy analysis. Due to the current development process of models and the implementation of models the potential is not fully exploited. In the current situation, the knowledge is hidden in the software implementation and the model strongly depends on one or a few researchers. In this paper we explore the possibilities to structure the development process and to turn model building into a group process. The initial experiences are very promising.

7.1 Introduction and problem statement

Within the Dutch Agricultural Research Institute several quality programs have been developed to increase the quality of models. It has become clear that there are significant gaps between the quality requirements of models and the quality of existing models. At this moment new protocols and new procedures are developed to increase the quality of the development process and the quality of the models. This paper tries to assess the current situation and identifies experiences with a new approach to develop models.

In section 7.2 the current situation is assessed. The existing models are briefly described and some general conclusions with respect to the quality of models are drawn. Section 7.3 describes a protocol for the model development process and the links of this process to group processes. Advantages and pitfalls of working with groups are described. In section 7.4 the application of interactive group modeling is applied on the manure and ammonia model. Section 7.5 gives a summary and conclusions.

7.2 Assessment of current situation

In this section the current situation with respect to models on a micro level within LEI is assessed. LEI also has models on a more aggregate level, but these will not be discussed in this paper. Section 7.2.1 gives a brief description of the available models. Section 7.2.2 describes the problems encountered with the current models and more important the current model development process.

7.2.1 Models on farm level used within LEI

FES

LEI has developed a Financial-Economic Simulation model (FES)[1], which is a useful tool for policy evaluation. For individual farms in the Dutch FADN the financial economic development is simulated for every year of the simulation period (usually 5 to 10 years). Starting from the commercial balance sheet, revenues and expenditures according to FADN, the model calculates the fiscal balance sheet, revenues and expenditures of the first year. To translate the individual farm outcomes to sector or national level, a weighting scheme is used. This factor indicates how many farms this farm represents.

APPROXI

APPROXI is a knowledge based system to predict individual behavior of farms in response to policy measures and to estimate the environmental and economic impacts of these measures.

Manure and Ammonia model

The manure and ammonia emission model is a model to calculate production, surpluses, transportation, export and processing of manure and minerals. With the model the manure production, the amount of excess manure and the ammonia emission are calculated at farm level. Transport, export and processing are calculated at regional level. Soil load of minerals is calculated at municipality level for each type of crop. The distribution of the surpluses of manure to places where manure can be applied is controlled by a linear programming package. Total costs (such as: distribution, storage, processing, export, application) are minimized at national level.

Besides these models there are a few other models at the individual farm level. These models (e.g. nutrient flow model and grain model) will not be described in detail because application of these models has been very limited in the last few years.

7.2.2 Problems encountered with current models

During the last decades it has become clear that building models and writing software for it gives rise to severe problems. Several textbooks on software engineering have pointed out what kind of problems will emerge if software is developed in a poor way. Poorly structured software becomes very easy unreadable for others. After many changes and extensions of the first product this is even true for the person who wrote the software. Poorly structured and poorly documented software has a very low degree of flexibility, of extendibility and can hardly be passed on to other developers. Making changes is tedious

[1] More information about this model can be found in Mulder (1995) and on the homepage of LEI: (http://www.lei.nl)

and error prone and therefore consumes a lot of time. After many changes the software program deteriorates and eventually it collapses.

The above is true for professional software developers, and it is even truer for researchers who spend only part of their time on software development. The situation on software of simulation models is even worse. Simulation models tend to change very rapidly during their lifetime: almost for every application of the model in a research project the model has to be adapted. Newer versions of the model are made. Different scenarios are run for each project. All this leads to alterations of code. After some time it will be very unclear what the computer model actually does. The consistency between conceptual model and actual computer model will be lost.

This classic way of the model building process of applied research models leads to the following major problems:

- there is no guarantee at all whether the actual computer model will be consistent with the assumed or documented conceptual model;
- adapting software of the model to newer versions means usually that previous version will be lost. Version control and also scenario control is not common practice and also very difficult to maintain. So, the reproducibility of results of previous research projects is lost;
- having written specific software for the model means that the real actual knowledge of the model is hidden within the software. Others than the writer do not easily understand the software. This means that the knowledge of the model is restricted to the researcher who wrote the software. This situation implies personal knowledge and not corporate knowledge. Consequently, if this person is anyhow no more available for the company, it appears to be very difficult (if possible at all) and time consuming to transfer the model to another researcher;
- the (scientific) quality of a model normally should be checked and advanced by peer reviewing. This is only possible if one can deduce how the model works. As has been pointed out above: documentation (if at hand at all) of the model isn't enough to review the model. The real working of the model is hidden within the software. So, the peer actually has to review or trace the software to reconstruct the actual working of the model. This is normally quite an impossible task. Besides the earlier mentioned weaknesses of the classic way of model building for applied research, also peer reviewing can hardly be done. Consequently the quality of models built in this classic way must widely be questioned;
- in the implementation of the current models, the model, the user interface and data input/output are closely intertwined. For each model the software code for this interface and data handling have to (re) developed. This results in a long development time and hence high development costs;
- the re-use of models is very limited. As described before the model knowledge is more or less hidden in the software. This makes the exchange of this knowledge and the re-use of components almost impossible;
- the closed intertwined architecture also complicates the interaction between models. A uniform definition of inputs and outputs is often lacking. Research problems that could potentially be answered by a combination of models are hard to tackle.

In response to the problems described in this section, several activities have been started to structure and organize the model development process in a better way. An important part of structuring is clearly defining the different steps in the model building process. This model building process will be described in the next section.

7.3 Model building and group processes [1]

This section gives a description of model building and the stages in the model building process. Subsequently we describe why model building becomes more and more a group process instead of an isolated activity.

7.3.1 Model building

Figure 7.1 gives an overview of the stages in the model development process. The stages: context analysis, conceptualization, mathematical modeling, data analysis and data modeling, implementation and validation will be described in more detail.

1. Context Analysis

This phase can be seen as an information analysis on a first, mainly global scope. The following issues are to be dealt with:
- collecting questions and problems of research topics;
- defining the objectives of the model to be built;

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Figure 7.1 Model building process

[1] Part of this chapter is based on the GSE documentation of Wietse Dol and Foppe Bouma (www.lei.dlo.nl/gse)

- elaborating the probability of reuse of the model in the future;
- if so, summing up the potential users (customers) of the model;
- definition of the domain of the model (what has to be included, and what remains excluded).

2. Conceptualization

In this phase a description has to be made of the assumed working of the focused part of the real world. Depicting the most important actors, stocks and flows, and their respective behavior, interactions, sequential ties, etc. into a modelled system can do this. A clear description of the external influences upon the internal parts of the modelled system is also needed. Part of the described interaction in the model might be in terms of hypotheses, which may lead to derived analytical research or even to analytical models. The conceptual description can be clarified by means of flow diagrams, object-oriented designs, etc.

3. Data analysis and data modeling

After the conceptualization, a first draft of data analysis has to be carried out. This phase concentrates on the required input and output data, and the data used to estimate parameters of the model. This stage implies the following:
- required output in detail;
- system requirement analyses, i.e. requirements for flexibility, sustainability, knowledge management;
- required data, sources and quality of data;
- preparatory transformation of row data, and/or estimation of data (parameters/coefficients);
- description of definition of data, data transformation (model decisions) and hypotheses around estimated data form analytical research (detailed description if carried out within the process of model building, or else acknowledgement of sources).

4. Mathematical Modeling

This phase is meant to formulate the model in a strict mathematical way. Important is to aim at a high level of abstraction in the model. Such an effort leads to a concise model with following advantages:
- much more understandable than a comprehensible and very detailed model, and therefore transferable to fellow researchers;
- a better grasp of the formal correctness of the model;
- a higher rate of flexibility for different research projects;
- much more apt to changes and desired extensions of the model.

5. Implementation

Implementation of the model will be done in GAMS. GAMS can be used in defining the model in an iterative way by refining the steps *Data Analysis* and *Mathematical Modeling* until the desired model is reached. GAMS can be used in testing the model on mathematical correctness, and will produce the formulated model on paper for review purposes, etc.

6. Validation

After the model has been formulated and results of the various runs of the model are available a validation of the model has to be carried out. Validation means checking and reflecting whether the formulated model (its conceptual framework, modelled hypotheses, abstraction, etc.) has proven a satisfactory description of the problem field at hand in the current research project.

This validation effort should be carried out by the research members of the project and also by peer reviewers. Outcome of the validation might be a reformulation of the conceptual model and hence all the phases of the model building process.

7.3.2 Why model building is a group process

Making a model is often seen as a project for only a few people. Indeed some years ago there were a lot of models built by a single person. Nowadays this almost looks impossible. There are several reasons for this:

1. The theory behind models has become more complex, i.e. some years ago models were built using one single field of science. Nowadays one needs a *multidisciplinary* approach to solve complex problems.
2. Building models means using a lot of data. The amount of data available, and used in models has grown over the last few years. This data has to be described, stored, and retrieved, i.e. this means that one needs *database experts*.
3. Data is often used to estimate certain model parts (e.g. parameters). This means that we need a statistician that will use data, modern statistical theory, and modern software to estimate model parts. Statistics has become too complex to be used correctly by others than statisticians. Modern software suggests everyone could do the job, but LEI projects from the past have proven that the quality of models is improved when using a specialist.
4. Having an idea how parts of the real life work, doesn't mean that one is capable of writing it down in a mathematical model or computer program. Formulating a mathematical model is difficult and one needs an *econometrist*, *mathematician*, or *biometrician* etc. to help you formulate the model.
5. The ICT has developed very rapidly the last few years. Not only new techniques like internet have developed, but also the usage of the computer by people has changed. LEI customers more and more use a computer and demand from us that we use/deliver them the most modern ICT developments. Instead of making a written report, we now want a multimedia report using e.g. GIS and other data manipulation/presentation techniques. Customers not only want a written report, but also want the model with a user-friendly interface. The examples above all show that for good user interfaces we need *ICT specialists*.

7.3.3 Dynamics of group processes

In the previous section it is described why model building is a group activity. A lot of research has been done to identify the factors that influence the quality of the group performance (see figure 7.2). These factors should be considered when it is decided to develop a model within a group. The performance of a group in a particular task depends on many interacting factors (Kleindorfer et al., 1993):

- the nature of the task itself;
- the composition of the group in terms of heterogeneity / similarity of personal characteristics and backgrounds;
- the agenda the group follows;
- the interrelationship among the group members;
- the degree of power held by each individual;
- the behavior of the group leader;
- the time pressure and incentive structure under which the group operates;
- the resources available to the group (knowledge, availability of data etc.).

The group process itself is central in predicting performance. For instance, performance depends on process issues such as communication and participative goal setting.

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Figure 7.2 Group problem solving and performance
Bron: Steiner, 1972.

Despite the obvious advantages of group activities, especially related to the integration of knowledge of the participants, there are a number of pitfalls, which could prevent groups from performing at their best level. Examples of these pitfalls are group think, conformity, and polarization.

Group think

Group think is the term to describe a rigid, narrow, ethnocentric style of decision making that can lead groups to make terrible decisions. The group's decisions are problematic because the group considers only a narrow range of information that supports its own agenda. In this way, smart groups of people end up making very unwise decisions. Often groups that failed to make wise decisions were highly cohesive, in which people knew each other well and liked each other. Insulation of the group due to secrecy of the issue or for other reasons also seemed to be a common factor. Strong directive leadership, with the chairperson saying clearly what he or she favored seemed also present. Finally high stress in terms of deadline, the importance of the decision and its complexity all seemed to be contributing factors to the resulting group think (Kleindorfer et al., 1993).

Conformity

In a group, people can be influenced to go against their better judgment. Hence one of the dilemma's in group performance is that two people should know more than one, but they start to influence each other so that the full benefit of their independent opinions is not utilized. It's not always clear whether subjects say what they don't believe or whether hearing other people's opinions actually causes them to change their own minds (Kleindorfer et al., 1993).

Polarization effect

Group discussion is often supposed to moderate extreme viewpoints, and opinions. However research has shown that, as a result of group discussion, not only was the group's final choice more risky than the average of members' choices before deliberation, but members' post test scores also moved in a 'risky' direction. Discussion appears to intensify attitudes, beliefs, values, judgments and perceptions. The phenomenon is called 'group polarization'. The phenomenon may occur because those holding extreme views are usually persuasive and may talk so much that other members may conclude that this is the group's position. Pressures toward unanimity (such as occur in juries) or social comparison processes (the new information presented stimulates members to compare their own opinions with the group) may also be important. Group discussion may also provide a forum for members to learn the group's values. The direction of the shift (risky or conservative) seems to follow the general direction of group values. Polarized decisions are a dramatic reminder that groups can take on a 'life of their own', divergent from the sum or average of individual members (Losh, 2001).

7.4 Group model building and the manure model

7.4.1 Goal of the model week

As described in chapter 2 the manure and ammonia emission model is a model to calculate production, surpluses, transportation, export and processing of manure and minerals. The model development started in the early eighties. The model is confronted with many of the problems described in section 2. Since the eighties the structure of the model has been revised a couple of time. At this moment the model reaches its technical limitations. The current software architecture causes problems in use of the model and in adaptation of the model. Changes in the model require a lot of time and money (changing the database structures and the user interface). Therefore it was decided to make a thorough evaluation and redesign of the manure model. To stress the group responsibility in building a model, a model week was organised. The goal of this model week was to analyse and define a manure and ammonia model for the following 5 to 10 years.

The following research questions were addressed:

1. Which policy issues and research questions related to the manure problems are relevant in the following years.
2. Which domain should the model cover to be able to answer the current and future research and policy questions.
3. How can this domain be modelled in generic mathematical terms with options for future changes and adaptations.
4. Which IT-architecture is most suitable for an appropriate and flexible implementation, which provides some guarantees for the transparency, maintainability and controllability of the model.
5. What are the recommendations for further development of the manure and ammonia model. A go no go decision has to be made based on analysis of the need for such a model and a cost/benefit analysis of redeveloping the model versus other approaches.

Figure 7.3 Setting of the model week

A model week was organized to address these questions. The model week implied bringing together model experts (3), domain experts (2) and a facilitator in a setting outside of the office (in order not to be disturbed by ongoing duties) (see figure 7.3). Documentation had been studied before the start of the week and other preliminary work had been conducted. See Vennix (1996) for a description of further organizational and practical issues in conducting group activities.

7.4.2 Important requirements

The week started with identifying developments in manure policies and expectations with respect to future research and policy topics, which would become relevant. Based on these developments a list of requirements was defined which the new model should fulfill. Some of the requirements are listed below. The domain experts did preliminary work. Stakeholders were interviewed to identify current developments and wishes.

Developing requirements:

1. Regional results.
2. Including more farm specific information (type of grass, type of soil, type of barn, type of grazing system).
3. Artificial fertilizer.
4. Costs of administration.
5. Connection to other models.
6. Detailed plot information.
7. Time of application.
8. Behavior of farmer.
9. Reliability and sensitivity of results.
10. Distance to nature.

The requirements were further operationalised in outputs; the model should be able to produce. The required output is listed below:

1. Manure and mineral production.
2. Manure and mineral residues at farm level.
3. Transport, handling and export of manure.
4. Ammonia emission (stable, storage, handling, meadow, application and artificial fertilizer).
5. Artificial fertilizer.
6. Mineral pressure of soil.
7. Cost and revenues (transport and storage, handling, export, application).
8. Infrastructure.
9. National manure surplus.

Figure 7.4 gives an example of a required output. In this figure the phosphate surplus per hectare is displayed for individual municipalities.

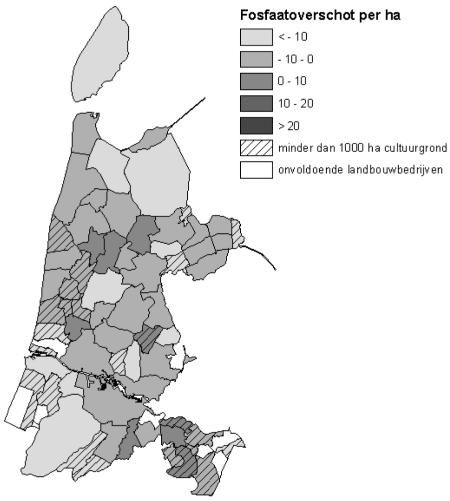

Figure 7.4 Example of output- phosphate surplus per hectare

7.4.3 Conceptual modeling of the problem domain

The foregoing activities were mainly dependent on the input of the domain experts. The role of the model experts was to ask questions to make sure that everyone had a shared idea of the future requirements of the model. In the conceptual modeling phase there was a much stronger interaction between the domain and model experts. The model experts were focused on trying to find more general structures and the domain experts made sure that the conceptual model was still a valid description of reality. This phase started with the nominal group technique. Nominal group technique is a procedure to generate and evaluate a number of ideas on an issue with a group of persons. The question was to list concepts that are relevant in the manure and ammonia emission domain. No judgment of the correctness and relevance of the concepts was made at this stage. The concepts are listed in figure 7.5.

Structure farm	Excretion
Emission coefficients	Policy rules
Number of animals	Crop areas
Farm management	Geographical units
Type of stable	Minerals
Costs of manure	Levy
Cost of artificial fertilizer	Animal density
Investments in low emission stables	Number of farms in region
Manure surplus	Mineral content food
Mineral pressure of soil	Start up companies
Parcel	Animal
Mineral pressure of surface water	Feeding system
Farm ending	Grazing grounds
Farm	Crop

Figure 7.5 Name of concepts

Subsequently, a start was made with linking the identified concepts into a conceptual model. In this stage, general structures were identified to make the model as general and flexible as possible. Several versions of the conceptual model were drawn on the available white boards. The models were tested by checking whether examples (brought forward by the domain experts) could fit into the conceptual model. An example of a conceptual model is given in figure 7.6.

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Figure 7.6 Part of the conceptual model

The generality of the solutions caused surprise and enthusiasm among the domain experts. Current problems and requirements for the future could fit into the description.

7.4.4 Mathematical modeling of the domain

When part of the domain area was modelled in conceptual terms, attention was shifted to the mathematical modeling. This appeared to be an important stage because at the start of the week there was some skepticism among the domain experts whether the problems could be described in mathematical terms. Figure 7.7 describes part of the allocation of manure to crops.

The mathematical modelling clearly showed that a mathematical description would be much more compact and powerful than a similar description in software code.

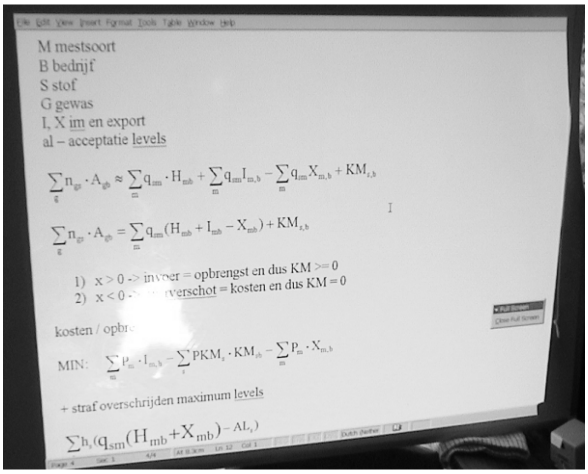

Figure 7.7   Evolving mathematical model

7.4.5   Defining approach for future development

At the end of the week attention was focussed on how to continue with these efforts. In order to avoid biases of group think and conformity issues were addressed such as: is the world really waiting for a manure model and does a manure model provide a positive impact on the LEI. It was shown that the model has a very important role in founding policy measures. In the past, policy making based on more general models resulted in a lot of resistance from farmers and stakeholders. In these situations there was a strong request for more detailed analysis on farm level, analysis that the manure model could provide.

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Figure 7.8   Impact of availability of manure model on the LEI

The results of the discussion of the impact of the model on the LEI are displayed in figure 7.8. Main advantages of the availability of the model are in sustaining the position of the LEI in the environmental network and the contribution of the model in integral research projects.

Guidelines for implementation

After the discussion about the role of the manure model attention was shifted to the discussion how to implement the model. Alternatives considered were: (1) continuation of the current model and (2) implementation of the model in GAMS/GSE.

GAMS is widely accepted in economic research as a high level language for a compact representation of large and complex models (see Brooke, 1998). GSE was developed to run the model, and to present the results. Furthermore GSE can be used in formulating and running different scenarios and in defining various versions of the model. GSE itself will take care of the configuration management task of preserving the various versions and scenarios. This guarantees reproducibility of results; also scenario comparison is made possible within the GSE-environment.

Main advantages of GSE:

- model input/output viewer;
- model version control, all sources are stored in a database;
- scenario inheritance (easy of use and keep database small);
- add documents/model knowledge to model version and scenario;
- scenario comparison (over all model versions & scenarios);
- multidimensional viewer;
- output: Printer, HTML, Excel, Graph etc.

The two alternatives for the implementation of the manure model were compared in terms of functionality, risks and the required resources. Continuation of the current model would require more resources and could not fully accommodate all developing requirements. Furthermore it would still not overcome the problems discussed in section 2. Redevelopment of the model in GAMS/GSE would require fewer resources, would provide much more functionality and would overcome the problems of section 2. Therefore it was decided to advice the latter approach.

7.5 Summary and conclusions

In section 2 of this paper current problems with models are assessed. Problems will emerge if software is developed in a poor way. This is mainly true for researchers who only spend part of their time on software development in combination with poorly structured software architecture in a rapidly changing world. The knowledge of the model is hidden in the software. Others than the writer do not easily understand the software. This creates a strong dependence on the developer of the software. In the current situation there is also a strong lack of control of different versions of the model. Changes in the model become very time demanding due to a strong connection between the model, the user interface and the I/O of the model. It also complicates the re-use of models and the cooperation between models.

To overcome these problems a protocol is described in section 3. It also describes why model building becomes more and more a group activity. The group process of model building and the protocol are applied to the development of the manure model. The model week to implement this is described in section 4.

This model week has had a positive impact. The context analysis has widened the basis and knowledge of the model. The preliminary work for the context analysis has resulted in useful knowledge about future requirements of the model. An integral evaluation of the requirements has taken place and priorities are set. The conceptual modeling has revealed that identifying and describing general structures can result in a more flexible model. New requirements could be fit into the general structures. The mathematical modeling clearly showed that a mathematical description can be much more compact than software code. Due to the general structures of the conceptual model attention was focused on the main issues instead of exceptions, which dominate current discussions about the manure model. The conclusion of this phase was that it is possible to model the manure domain in mathematical terms. At the end of the week an implementation of the model was discussed which would overcome the model problems described in section 2 and which would be more adaptable to new developments.

All the participants had a positive feeling about the model week. The domain experts and model experts recognized advantages of this approach. The domain experts were relieved to see that this approach provided solutions for current problems. Enthusiasm increased even more when they recognized that new requirements could be more easily fit into the model. Due to the inclusion of more behavioral aspects into the model, the rationale of the existence of the manure model, as an economic model, has strongly increased.

Acknowledgements

We would like to thank the other participants of the model week for the cooperation that formed the basis for this paper. The participants were Foppe Bouma, Wietse Dol, Diti Oudendag, Harry Luesink, Tim Verwaart and Hans Vrolijk.

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8. A discussion on the 'farm audit' proposal in the Mid Term Review of the CAP

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8.1 Introduction

The European Commission's Mid Term Review (MTR) of the CAP's Agenda 2000 proposes to introduce farm audits. As PACIOLI is an expert group, resulting from a former EU concerted action, with experts in farm accounting, FADN, Information Systems and micro economic policy analysis, it was seen as appropriate to use some of the time in the workshop PACIOLI X (early December 2002 in Italy) to discuss this proposal. We first describe the proposal in the MTR and then report the main remarks from the discussion with experts. These remarks have been elaborated afterwards by the reporting author.

8.2 Proposal

The MTR is presented by the Commission as a step 'towards a policy that pleases everybody'. It notices that consumer confidence in food and agriculture is (partly) lost. Transparency of on-farm processes will help to restore consumer confidence. To make cross-compliance of CAP payments with required standards trustworthy.

In a speech (11 July 2002 at the 13th congress of international farm management at Wageningen) mr. Fischler mentioned two purposes of such a farm audit:

- to help farmers meeting required standards of modern agriculture;
- win back the trust of consumers.

8.3 Issues from the discussion

The topics raised in the open discussion at the workshop focussed on three main issues:

- the feasibility of a farm audit;
- the effects of a farm audit;
- the effect for the FADN.

We take these one by one.

The feasibility of a farm audit

- First of all it is not so clear from the MTR what has to be audited:
  - that there has been no fraud in requesting and spending the payments (compare audits on the paying agencies or the European Social Fund);

- that the cross compliance obligations have been fulfilled ?
- that the farm works conform the good agricultural practice protocol ?
- ISO 14000 on environmental impact?
- Corporate Social Responsibility (people / profit / planet?)

It seems logic not to start with the last two options that are for the moment more theoretical. But a choice seems necessary between contractual cross compliance issues and good agricultural practice on the farm in total. The second seems necessary from the point of view of transparency.

- Is it technically possible to audit a farm? For larger farms (like in the candidate countries), who have often their own farm-based bookkeeper, it seems to be possible (at least in the classical sense of an audit on the accounts). The literature has doubts on small farms with collusion problems, without a good administrative system in which tasks are separated. However in farms integrated in the market economy this is less and less a problem. In the Netherlands in the early nineties a big project was carried out to investigate the auditability of small family farms for their mineral accounts. The conclusion was that it was possible and farms were obliged to have an audit of their financial and mineral accounts integrated.
- It is unclear from the MTR proposal who should do the auditing. There is a free, specialised market for audits with financial accountants and companies as SGS and (in Germany) DLG providing these services. In compliance audits for organic farming and Eurep-Gap the latter type of organisations does the work. Financial accountants can be of interest if financial flows have to be checked. It could be a big market, and it is not so attractive to have it done by government agencies (need quite some staff, not in line with more responsibility for the sector/food chains; costs are nearly automatically for the government in stead of the sector).
- A system of inspection upon inspection could be useful, where the private sector does the first level of audits (auditing the farms) and a government agency checks the auditors. From the Netherlands however it was reported that this asks for a certain mind set with the government agencies. This system was proposed in the Dutch mineral accounting system with the aim to keep costs low (the mineral and financial accounts could then be integrated and audited at one time, also leading to better checks) and to have them paid by the farmers. In practice however the government agency involved did not use the audit statements (that then became an unnecessary burden) and had the work done by it's own staff (becoming bigger and bigger). They also started to use other (earlier) deadlines the tax offices, which increased costs for farm accountants as they had to turn to their files twice.
- It is unclear what the cost could be. If this is rather high the proposal will certainly be seen more as an administrative burden then as a support to help farmers meeting future standards. In the Netherlands quite some research work is carried out to see in how far the administrative burden can be decreased, also by putting 'the farmer and his data central' in stead of at periphery of data-chains that have different data definitions for every product chain and government regulation. In Denmark the administrative burden is also seen as an important issue.

The effects of a farm audit

- In advance the effects are not so clear. For large central European farms an advantage could be that the on-farm bookkeeper gets professional support. In a Czech project on creating the FADN it became clear that some farms (and the FADN) had quality problems with their bookkeepers. Good ones left for the scarce labour market in Prague. Farm managers came from a production background and found it problematic to advice these specialist employees. So an audit could help.
- It is not so clear how an audit as such could help transparency, unless something is published or available on demand.
- A farm audit looks a logical next step: in the sixties Commissioner Mansholt introduced obliged farm accounting as a 'cross compliance' measure in investment plans. A modern farmer should have accounts, otherwise he was not worth the credit. That idea met resistance too, but was maintained. Against that background it is not so strange that Commissioner Fischler now introduces farm audits for modern farms.
- Strange enough no literature is known to the experts in which the effects of obliged accounts have been evaluated. References on the use of accounting systems and accounting software exists, with a big debate in how far (obliged) systems make better farmers.
- Costs of an audit are smaller (per unit of production) on larger farms, so there is a size effect.

The effect for the FADN

The FADN benefited in the past from the obliged farm accounting. How about the farm audit idea?

- It can lead to an additional database that can be used as an administrative input for FADN (compare databases on cattle movements or IACS).
- It could lead to additional databases that can perhaps replace RICA/FADN, especially if not only data on subsidies and cropping patterns are gathered, but also some data on yield and farm family income. Note however that companies like SGS very often not build up database systems as they are afraid to be obliged to hand over individual data to the government (tax).
- The FADN itself could report if a farm is or has been audited and with which result (e.g. '2 minor mistakes').

Overall conclusion: a very interesting proposal that is in line with modernisation of farming. However quite some questions remain on the content of the proposal and its technical and political feasibility. In any case it could make sense to start a project with further discussion and experimentation on the farm audit option.

9. Environmental accounting in Italian farming: a stepwise approach towards the Total Economic Value

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Abstract

The paper presents a step-wise enterprise approach to environmental accounting in agriculture. It starts with conventional balance sheets: income statement - profit and loss of four agricultural enterprises following usual accounting principles. A second step separates environmental/recreational activities from conventional ones, i.e. agricultural products and timber, from recreational services. A third step outlines near market values, as perceived by the entrepreneurs that is private values - hidden assets and liabilities. A fourth step opens up to public goods/bad and externalities making possible a quantification of welfare variation - public effects. This last step aims at incorporating non-market benefits and costs, or, at least, providing a framework for their incorporation, as far as they can be shown in monetary terms, or other means. Satellite accounts and addenda including physical/biological aspects can therefore be used. The methodology, though enlarged to environmental/social issues, remains strictly based on accounting principles. It has to be clear that the model is linked to specific aims: management and, above all, local public policy. In fact economic value does not exist in the 'abstract', it must be related to practical clear stated objectives, otherwise it is just mere growing of data.

Keywords: Environmental accounting, Stepwise procedure, Farming

9.1 Introduction

This paper illustrates a stepwise procedure for environmental accounting in agriculture. Traditional accounting principles are maintained throughout the various steps of the proce-

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[1] The paper is part of a EU financed research on 'Tools for evaluating investment in the Mediterranean mountain areas - an integrated framework for sustainable development - MEDMONT QLK5-2000 01031', undertaken in collaboration with Mediterranean Agronomic Institute of Chania (MAI.Ch) - Department of Environment and Renewable Resources (Dr. Vassiliki Kazana, co-ordinator, Dr Angelo Kazaklis); Institut National de la Recherche Agronomique (INRA) (Dr. Francois Bonnieux); Consejo Superior de Investigaciones Cientificas (CSIC) (Dr. Pablo Campos Palacin); University of Ljubljana (GOZD) Biotechnical Faculty Department of Forestry and Renewable forest resources (Prof. Lidija Zadnik). A preliminary version of this paper has appeared on a special issue of 'Investigación Agraria', n.1, 2001, devoted to: Forestlands new economic accounting: theories and applications, ed. Pablo Campos.

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dure allowing, however, to take into account environmental effects - public goods and bads as well externalities [1] linked to farming.

The environment is conceived *latu sensu* including physical aspects (e.g. soil and water), nature and landscape recreation.

The scope of the paper is to provide a viable procedure useful to both private entrepreneurs and public decision-makers. The various steps mark the passage from private to public interests and the related objective functions from the traditional net income to an environmentally adjusted net income a proxy of people welfare.

Recent developments of environmental accounting at national level are outlined, stressing how a true environmental accounting needs local farms references. It is therefore proposed a stepwise procedure starting with traditional accounting (balance sheet and income statement) integrated step by step with the consideration of public goods/bads and externalities. Specific, real world examples of accounting are also reported. It is therefore tested how the proposed methodology is able to encompass various goods and bads as well externalities linked to farming.

9.2 From macro (national) to micro (enterprise) environmental accounting

Environmental accounting has been developed since the 60s - 70s at national level to answer growing worry about the state of the environment and the exhaustion/depletion of natural resources. Nordhaus e Tobin (1972) proposed to calculate the so called Net Economic Welfare, adjusting the national income according to the state of natural resources. Consumption of natural capital and environmental stewardship costs should have been taken into consideration (Lutz, 1993). Guidelines to adjust national accounts have been therefore provided (United Nations, 1968). A support towards environmental accounting, as a tool to verify sustainable management of natural resource, has been provided by Bruntland Committee (1987) and the Rio Summit (1992). More environmentally aimed approaches have been therefore proposed (Peskin and Lutz, 1993). The manual for national accounts produced by the United Nations (System of National Account - SNA, 1993) has been particularly significant and accepted by the European Union: European System of National and Regional Accounts - ESA (EUROSTAT, 1995).

The reference to conventional enterprise accounting

Environmental accounting carries on two features and needs (to a large extent ignored up to now by national accounts): from one side making reference to local (enterprise) level, from the other, consequently, the adoption of traditional enterprise accounting. Incidentally this approach was regarded as unavoidable by Daly (1988), supporting Fisher’s old national dividend in opposition to Keynes calculation of national income. He states: ‘had the national accounts developed in accordance with Fisher's concepts, their extension to cover environmental services and ecological and geological capital depletion would have been

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[1] Public goods (bad) are supposed to be external effects of which the manager is aware and willing to provide, meanwhile externalities are unintended.

obvious and easy, except for valuation problems for services without market. As it is now incorporation of ecological services and natural capital must be very ad hoc, and in fact it may ultimately be necessary to adopt Fischer's approach.

Quite clearly for economic policies applied after the 30s there was a need to account primarily for economic financial aggregates like investments, production, demand and employment, overlooking the assets and particularly natural resources. When scarcity of natural resources and environment degradation/depletion became at least equally important, in the second half of 20th century, methods of accounting needed to be changed to reflect the new reality.

One such interesting attempt was made by Adger e Whitby (1991 e 1993) who proposed modifying British agricultural product by adding the value of carbon fixation and other public services while deducing defensive expenditures. The overall results indicated a 20% increase in net product. The Economist (January 18th, 1992) commented: 'allow for the pleasure given by the green belt and national park, and throw in something for the effect of tree planting on mopping up global warming carbon dioxide and *presto* a sustainable net product is 25% bigger than net product'. Quite opposite the attitude of various other authors stating that a 'wide range of unaccounted environmental resources is not a reason for including these benefits', what counts are significant deterioration that can be avoided or enhancement that can be encouraged (Lindall, 1995). Therefore the question is consideration of total flows or limitation to variation, and around this problem rests the main issue of environmental accounting.

Though tentative, these attempts paid new attention to building environmental accounts in which the information flow should follow a circle from 'micro' to 'macro', and then back to 'micro'. This was considered essential towards promoting positive and fight negative environmental impacts at the local level, where they are produced, according to the well known aphorism: 'think globally, but act locally'.

Enterprise environmental accounting should have allowed to bridge the gap, and answer the need to act locally, meanwhile allowing environmental variables to be included within decision-making process (Bartolomeo, 1997). It is a need particularly felt in farming and forestry where public policies aimed at supporting the sector are based on promotion of positive impacts and prevention of negative ones, while traditional finance support is conditioned to respect certain environmental standard, the so called cross compliance or eco-conditionality. This logic has been stressed since the 1992 Common Agricultural Policy (CAP) reform, even more stringently confirmed by 1999 Agenda 2000, particularly Regulation n. 1257/99 on Rural Development in which premiums are considered for those adopting environmentally beneficial farming and forestry practices. Notwithstanding these development, very little has been done for 'greening' accounting methodologies in agriculture and forestry except few applications including those of Campos (2001 and 1998), Campos and López (1998), Ciani et al. (1998), Caggiati et al. (1998), CESET-AAVV (1998) and Merlo (1996). Quite clearly they could represent, once widely accepted, the an instrument for supporting the so-called 'greening' of European Union agricultural and environmental policies.

The consideration of biota: another key issue in agriculture and forestry

In agriculture and forestry environmental accounting, another key issue arises from the consideration of the various *biota*. One should think about the forest-growing stock, biodiversity, fauna and flora resources. EUROSTAT (1995) adopting United Nations SNA (United Nations, 1993 a e b), tried to avoid some contradictions linked to a superficial consideration of natural and semi natural *biota* that are to an extent non renewable, as can be the case of a natural forest-growing stock. It is therefore made explicit the difference between a renewable *biota* like the case of poplars plantation growing stock and a hardly renewable growing stock like a natural and semi natural forest ecosystem, managed according to close-to-nature forest principles within protected areas. Misunderstandings remain for forests outside protected areas where EUROSTAT separates the soil defined as a 'material good' from the growing stock. This can lead to mistakes as shown by Harrison (1993) who states that 'the manifest error in this assumption' is particularly evident 'with regards to tropical rain forest'.

In defining stocks and flows of *biota*, one must separate the object of cultivation into two categories: that which is renewable and that which is not renewable - or, at least, not renewable once the limits of sustainability are exceeded. This crucial issue does not seem to have been solved satisfactorily. In addition the problem goes far beyond forest ecosystem and the related growing stock, involving soils and other potentially depletable resources. Even more relevant is the case of biodiversity, much affected by agriculture and forest uses and practices, where are far from clear the boundaries between what is a stock and what is a flow, what is renewable and what it is not.

9.3 A proposal of enterprise environmental accounting

As already shown, methodologies and schemes for enterprise environmental accounting in agriculture and forestry are far from being codified and unanimously accepted. Up to now it is mainly a matter of experiments based on voluntary adhesion and, in any case, underscoring difficulties in definition, quantification and pricing of environmental impacts of individual enterprises. Even a common terminology is still lacking. Nevertheless there is a need to make the various proposed schemes homogeneous for the sake of transparency and comparability among enterprises, and consistency with national environmental accounting. There is also a search for a compromise between the need to inform the external world, mainly linked to agricultural and forests policies, and the usual confidential nature of management accounting.

The methodology proposed herein is derived from conventional financial accounting and tries to integrate, step-by-step, environmental values within the accounting system. The main problem is how to consider the various items of the balance sheet and income statement which do not have a market price, for instance pollution, landscape quality, biodiversity and in general the state of the environment that is depletion/degradation of natural resources. These environmental values are far from being well defined, let alone quantified. The uncertainty concerns also the sign of the impacts: positive or negative. For instance a forest is providing important positive effects if managed through continuous coverage uneven aged close-to-nature systems. Also more intensive forest systems (even aged with clear felling) are providing positive effects if compared to arable land use. These effects, however, can be interpreted as negative when compared to uneven-aged continuous coverage. It all depends upon the reference points: thresholds benchmarks.

In order to solve these problems, preliminary to any possible approach to environmental accounting, the proposed methodology has adopted the criterion to make reference to normal ordinary practices under the hypothesis they are good practices. Something like this is, to a certain extent, applied by the Italian Act n.146/94 adopting the so-called 'Nitrate Directive' (CEE 676/91) of the EU. Article 37, following the request of the Directive, introduces the concept of 'Good Agricultural Practices Code', to be prepared by the Ministries of Agriculture of the various EU member countries. The Italian Ministry of the Environment (MIRAF, 1995) has made the code operative with a Decree of 19 April 1999 (Benedetti e Sequi, 1999). Notwithstanding the ambitious term 'code' it is, however, a matter of guidelines, a 'process' towards an improved way of farming. All this means reference to practices, and environmental impacts, of farmers adopting crop patterns and techniques, which are normal, ordinary, neither better, nor worst, than the average. Given, however, the widespread availability of extension services, and the environmental awareness of farmers, the criterion also supposes that 'normal practices', coincide to what today are considered good practices including provision of public goods and services, prevention of negative externalities and, in the end, conservation of natural resources. To a certain extent one can also assume that good ordinary practices should correspond to so-called BAT (Best Available Technologies).

This does not imply that negative environmental impacts are not taking place, as it is the case, after all, of many human activities. It is rather supposed that negative impacts must be restricted to acceptable benchmarks, defining what is positive, what is negative, and what is acceptable (OECD, 1998; Gatto et al., 1999; Gatto et al., 2000). Incidentally this concept is well established in land appraisal where real estates are valued according to ongoing normal management and practices. Also accounting practice makes reference to GAAP: Generally Accepted Accounting Principles.

One can conclude that accounting as a pragmatic exercise accepts, and needs, approximation to normality.

Figure 9.1 tries to outline what could be the benchmarks, making clear that different attributes of the environment, should be considered such as the physicals environment, the natural one and the landscape-recreational. This also means that a certain practice having positive impacts for one attribute can have negative impacts for another. For instance irrigation and fertilisation can 'green' meadows and pasture (positive landscape impact), decreasing however the natural environment - negative impact.

Environmental accounting methodology proposed herein, once the crucial issue of benchmarks and references is solved, can be articulated in four steps, each of them deepens the accounting of environmental values. Every step, or level of accounting, should correspond to subsequent consideration, or integration, of the various enterprise outputs-inputs and state of the stock.. As shown by table 9.1 each step is significant of a wider consideration of enterprise objectives, and impacts, starting with private aspects (profit and loss) and opening up, gradually, to the non market public - social profit that is welfare including environmental quality. In other words each level of deepening the analysis (accounting step) corresponds to an enlarged concept of profit and loss which tries to express, trough a subsequent approximation, the environmental impacts of the enterprise. Both components of the accounting system, that is income statement and balance sheet, are considered and affected.

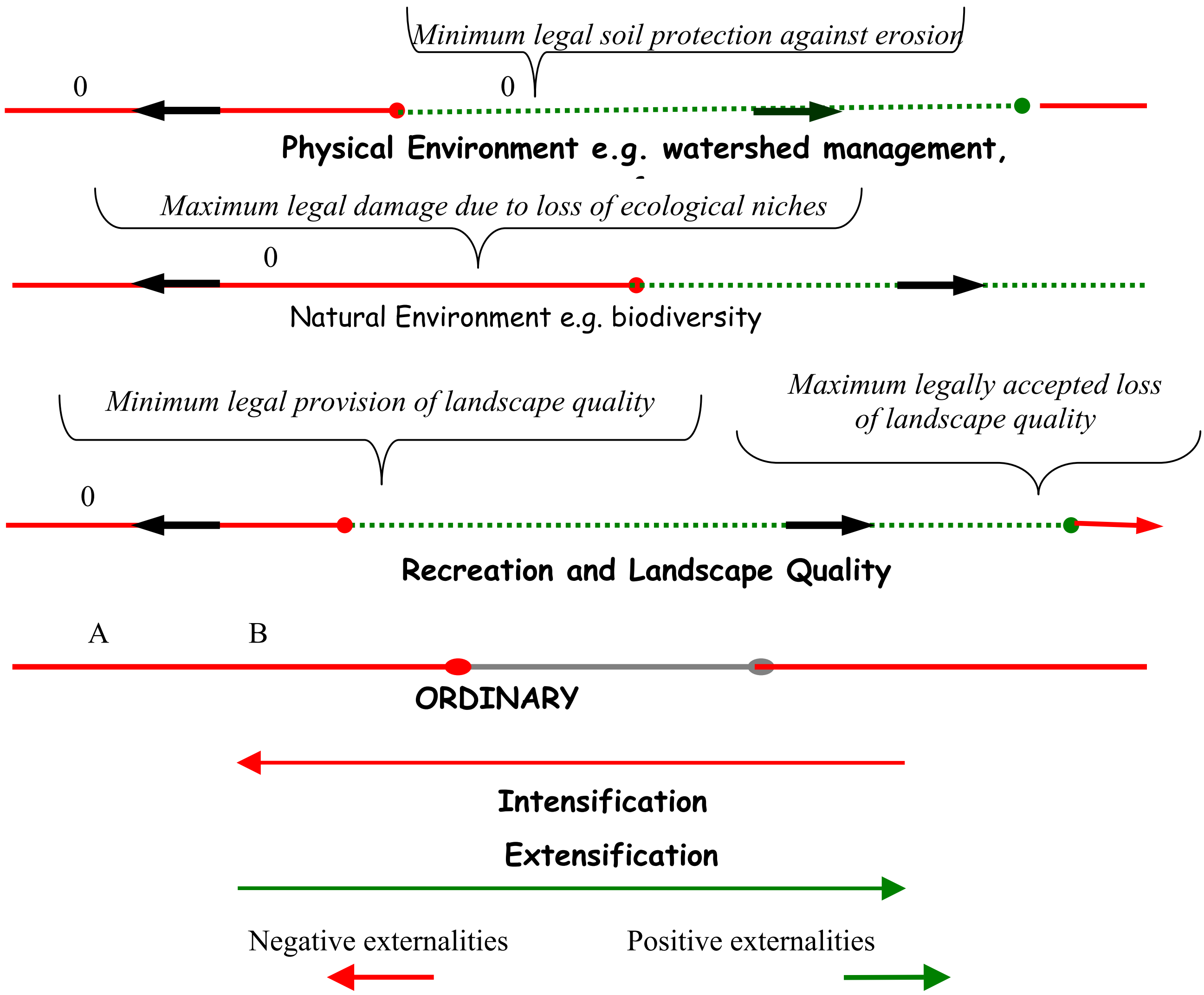

Figure 9.1 Positive and negative impacts of farming and forestry: possible benchmarks
Source: Gatto and Merlo (1999; 2000).

In practice the first step (level 1) is given by the traditional balance sheet and income statement which shows the total equity and the net income (profit/loss) for the year. The second step tries to separate the net income and equity/liability, making reference from one side to conventional activities and from the other to the production of environmental goods and services considered by market prices (level 2).

The third step accounts for environmental 'hidden' values as perceived by the enterprise both in terms of income and equity (level 3). Hidden values are those that, without immediate market effects, sooner or later, can be felt by the market under specific circumstances e.g. collapse of natural capital (soil degradation, forest fires, etc) also linked to non sustainable practices. The market can anticipate these effects whenever real estates are put on sale.

The last step (level 4), certainly the most difficult to quantify, tries to integrate within the balance sheet costs and benefits consisting of public goods/bad and externalities. What is expressed through the fourth step is a kind of social equity and income, that is welfare, positively or negatively affected by agricultural and forest enterprises [1].

Steps or levels	*Items included in the balance sheet*	*Accounting objectives*	*Type of profit and loss*
1	Financial receipts and expenditures	Private	Financial profit and loss
2	Financial receipts and expenditures separated according to ordinary and environmental activities	Private with separation of ordinary and environmental activities	Financial profit and loss separate between ordinary and environmental activities
3	Incorporation of non-monetary costs and benefits concerning the enterprise alone (hidden values)	Private with consideration of hidden environmental costs and benefits	Financial profit and loss plus non-monetary private profit and loss
4	Incorporation of non-monetary costs and benefits concerning the society as a whole	Public	Social profit - welfare

Figure 9.2 The step wise approach to enterprise environmental accounting

9.4 Case studies of enterprise environmental accounting

In order to show the application of the proposed methodology, and its outcome, within different enterprises and under various circumstances, four applications are reported:

- a Large Public Forest of Eastern Alps where important public environmental and recreational benefits are provided in addition to traditional timber production;
- a Large Lowland Public Farm with mixed output including cereals and beef plus public benefits recently developed particularly in a coastland pine wood;
- a Medium Pre Alpine Private Farm where output is linked to a diary production plus agritourism and quality products;

[1] Quite clearly the methodology of environmental accounting proposed herein shows striking similarities wit cost-benefit analysis. As stated by Little and Mirlees (1974) 'the essence of a cost-benefit analysis is that it does *not* accept that actual receipts adequately measure social benefits and actual expenditures social costs. But it does accept that actual receipts and expenditures can be suitable adjusted so that the difference between them, which is therefore very closely analogous to ordinary profit, will properly reflect the social gain. The prices used, after such adjustments have been made, will be called ‘social accounting prices'; or for short accounting prices'. Siniscalco (1995) has also noted these similarities.

- a Small Lowland Horticultural Farm adopting organic farming and quality schemes where produces are sold directly to the consumers.

Full accounting results are reported only for the first enterprise. For the remaining three only the net income at the various accounting steps is shown.

A Large Public Forest of the Eastern Alps

With 20,000 ha publicly owned and managed, it is one of the largest forest properties of the Italian Eastern Alps. The area has been designated, but not yet approved, as a National Park. Forest regime, watershed management bonds and various other measures protect the area where the forest enterprise is located. In addition it includes two nature reserves.

Table 9.1 Income statement (1998-2000, average values)

	Euro
A) Revenue	2,190,340
Timber sold	566,486
Timber redistributed to local inhabitants	363,325
Subsidies from the Ministry of Agriculture (MiPAF) to support personnel salaries	988,113
Compensation from the Ministry of Agriculture (MiPAF) for forest fire Services	108,232
Other compensation for environmental enhancement measures	91,448
Contribution to local inhabitants timber measurement	22,379
Rents of building to personnel	16,910
Rents of buildings to third parties	8,675
Mushrooms picking permits	15,494
Small wood collection and quarry concessions	6,300
Other temporary concessions (e.g. ski tracks)	1,748
Hunting and fishing concessions	1,229
B) Cost	1,317,075
Salaries and social security	1,064,196
Forest fire Services	88,014
Consumables and energy	78,754
Landscape and environmental stewardship expenditures	16,165
Fauna protection and care	6,197
Forest management and stewardship	11,119
Depreciation , maintenance and insurance of equipment and machinery	41,486
Depreciation, building maintenance and insurance	8,257
Research and Development (R&S)	2,200
Public Relations (PR)	685
C) Result (A-B)	873,265
D) Other revenue and cost of production	-48,096
Financial revenue	7,360
Roads maintenance cost	-13,699
Building maintenance cost	-41,757
E) Result before taxes (C+D)	825,169
G) Income taxes	-25,823
NET INCOME (PROFIT/LOSS) FOR THE YEAR (E+G)	799,346

Balance sheet

ASSETS	Euro
A) Fixes assets	120,885,135
Soils and growing stock (forests, meadows, pastures and other land)	117,269,841
Buildings	3,164,848
Technical equipment and machinery	450,446
B) Depreciation accruals	-2,013,623
Net assets (A+B)	118,871,512
Cash	4,356
Receivables	2,582
Total	118,878,451
EQUITY AND LIABILITY	
Debts	4,930
Total	4,930
Total equity	118,873,521
Of which net income (profit/loss) for the year	799,346
Total equity and liability	118,878,451

Nature conservation (e.g. protection of bears) and recreation (185,000 visits per year) are paramount objectives. But timber production remains essential representing the only revenue able to support the management cost. In fact more than 10,000 ha, are still mainly devoted to timber production. Annual felling is 30,000 m^3 while growth should be over 50,000 m^3. Average growing stock, including marginal non-productive areas, is between 250 and 300 m^3/ha. Local residents are still entitled to a share of total timber production: some 10,000 m^3.

The income statement (table 9.1) shows how timber is the most relevant item of revenue, contributing for 930,000 euro to the production value. However, 363,000 euro are not really received by the enterprise, but are redistributed to the local residents entitled to 'wood rights'. Amongst revenue are considered the public subsidies (988,000 euro from MiPAF) aimed at covering the personnel salaries almost entirely [1]. Other 108,000 euro (again provided by the MiPAF) are given as a compensation for the forest fire services provided by the enterprise. Some 91,000 euro are received for undertaking environmental enhancements. Concessions and rents also contribute to the total revenue.

One can certainly say that the proportion of the various revenues is consistent with the general objectives of the enterprise: seeking a balance between conservation and timber production, in order to support management cost while also providing round wood for the local sawmills industry.

The total revenue less cost, which is the enterprise result from operation, amounts to 873,000 euro, while the net income is positive for a remarkable 799,000 euro. One should,

[1] The enterprise is managed by the Forest Service which personnel salaries, paid by the State, has been considered as a subsidy justified by the various public benefits provided to the public. This subsidy has therefore been included within the revenue. It appears of course also as a cost.

however, not overlook the role played by subsidies and compensation, to a certain extent 'fictitious revenue', amounting to a relevant 1,18 million euro, aimed at covering personnel salaries, fire control, and environmental maintenance and enhancements. Without these public transfers the enterprise will register a heavy loss. One should also account for the timber redistributed to local inhabitants which value is far from negligible at 363,000 euro.

Table 9.2 Income statement disaggregated between conventional and environmental market productions (1998-2000, average values)

	Euro
A) Revenue of conventional production	1,694,537
Timber	566,486
Timber redistributed to local inhabitants	363,325
Subsidies from the Ministry of Agriculture (MiPAF) to support personnel salaries	710,462
Contribution to local inhabitants timber measurement	22,379
Rents of buildings to personal	16,910
Rents of buildings to third parties	8,675
Small wood collection and quarry concessions	6,300
B) Cost of conventional production	771,742
Salaries and social security	691,516
Consumables and energy	49,615
Depreciation, maintenance and insurance of equipment and machinery	24,723
Depreciation, maintenance and insurance of buildings	5,202
Public Relations	685
1) RESULT OF CONVENTIONAL PRODUCTION (A-B)	922,795
C) Revenue of environmental production	495,803
Subsidies from the Ministry of Agriculture (MiPAF) to support personal salaries	277,651
Compensation from the Ministry of Agriculture (MiPAF) for Fire Services	108,232
Other compensation for environmental enhancement measures	91,448
Mushrooms picking permits	15,494
Other temporary concessions (e.g. ski tracks)	1,748
Hunting fishing concessions	1,229
D) Cost of environmental production	545,333
Salaries and social security	372,679
Fire Services	88,014
Consumables and energy	29,139
Depreciation, maintenance and insurance of equipment and machineries	16,762
Landscape and environmental stewardship expenditures	16,165
Forest management and stewardship	11,119
Fauna protection and care	6,197
Depreciation, maintenance and insurance of buildings	3,055
Research and Development (R&S)	2,200
2) RESULT OF ENVIRONMENTAL PRODUCTION (C-D)	-49,530
3) AGGREGATED PRODUCTION RESULT (1+2)	873,265
E) Other revenue and cost of production	-48,096
Financial revenue	7,360
Roads maintenance cost	-13,699
Building maintenance cost	-41,757
F) Result before taxes (3+E)	825,169
G) Income taxes	-25,823
NET INCOME (PROFIT/LOSS) FOR THE YEAR (F+G)	799,346

Balance sheet

ASSE7TS	Euro
A)Fixed assets	120,885,135
Soils and growing stock (forest, meadows, pastures and other land)	117,269,841
Buildings and other constructions	3,118,367
❁ Ecological Museum	46,481
Equipment and machinery	450,446
B) Depreciation's Accruals	-2,013,623
Net assets (A+B)	118,871,512
Cash	4,356
Receivables	2,582
Total	118,878,451
EQUITY AND LIABILITY	
Debts	4,930
Total	4,930
Total equity	118,873,521
of which net income (profit/loss) for the year	799,346
Total equity and liability	118,878,451

The assets balance sheet of table 9.1 again shows the total value of equity and liability amounting to more than 118 million euro, a value determined mostly by the forest: soil and growing stock. It is a value largely hypothetical being a public property, bonded by law to remain in public hands and not to be sold.

A more realistic description of the enterprise management is represented in table 9.2: the second step of environmental accounting where are highlighted from one side revenue and cost linked to conventional production (timber) and, from the other, revenue and cost linked to environmental activities reflected by market prices. Conventional production result is positive for some 922,000 euro, while the environmental production gives a negative result of 49,000 euro. This loss would be much higher without subsidies and other payments from MiPAF, justified, however, by the performance of the important public functions already mentioned. One can see that environmental productions arise, in any case, a negative result, while conventional timber production can generate a profit whenever the timber redistributed to local inhabitants is accounted for.

Total equity and liability value of the balance sheet, equal to some 118 million euro is fully attributed to conventional productions. It is a simplification given the multi functionality of forests, clearly stated by Italian legislation. A small part of total fixed assets marked with ❁ in table 9.1 equal to 46 thousand Euro is nevertheless given by an ecological museum, a cultural initiative quite linked to environmental and recreational management of the property.

Table 9.3 Income statement with incorporation of private non monetary values (1998-2000, average values)

	Euro
A) Revenue of conventional production	1,694,537
B) Cost of conventional production	771,742
1) Result of conventional production (A-B)	922,795
C) Revenue of environmental production	495,803
D) Cost of environmental production	545,333
2) Result of environmental production (C-D)	-49,530
3) Aggregated production result (1+2)	873,265
E) Other revenue and cost of production	*-48,096*
F) Result before taxes (3+E)	825,169
G) Income taxes	-25,823
4) NET INCOME (PROFIT/LOSS) FOR THE YEAR (F+G)	799,346
§ L) Growing stock increase	369,602
§ M) Quota Risky stands (avalanches/landslides)	-1,695
§ N) Quota unstable risky stands (wind)	-4,238
§ O) Quota risky stands of pinewood (fires)	-6,197
NET INCOME (PROFIT/LOSS) FOR THE YEAR ADJUSTED FOR PRIVATE HIDDEN VALUES (4+L+M+N+O)	1,156,817

Balance sheet

ASSETS	Euro
A) Fixed assets	120,885,135
B) Accruals	-2,013,623
Net assets (A+B)	118,871,512
§ Growing stock increase	369,602
Cash	4,356
Receivables	2,582
Total	119,248,053
EQUITY AND LIABILITIES	
Debts	4,930
§ Stands risk accrual (avalanches/land slides)	169,540
§ Stands risk accrual (wind)	169,540
§ Stands of pine wood accrual (fires)	61,975
Total	405,985
Total equity	118,842,068
Of which net income (profit/loss) for the year adjusted for private hidden values	1,156,817
Total equity and liability	119,248,053

The third step of environmental accounting takes into consideration private hidden values (marked with § in table 9.3). Such a consideration increases the net income of 369,000 euro reaching more than 1 million euro. It is a positive variation due to the increase of growing stock (a sort of natural capital) left in the forest. This product is yearly accounted in the income statement and then consolidated in the balance sheet. Environmental risks due to natural hazards (avalanche, landslides, windfall and fires) partially due also to poor past management are accounted as annual quota in the income statement - around 12,000 euro yearly, then consolidated in an accrual of 400,000 euro. Even if it is not set aside each year, this cost expresses the risk carried on by current management. Fires for instance in the last 50 years have destroyed hundreds of hectares of forest. The yearly quota covering the various risks depends upon return time of hazards. The effects of accounting for all 'hidden private values' are felt positively on the income statement given the remarkable saving of growing stock and negatively by the balance sheet given the weight of accruals.

Table 9.4 Income statement with incorporation of public non monetary environmental values as addenda and satellite accounts, 1998-2000 average values)

	Euro
A) Revenue of conventional production	1,694,537
B) Cost of conventional production	771,742
1) Result of conventional production (A-B)	922,795
C) Revenue of environmental production	495,803
D) Cost of environmental production	545,333
2) Result of environmental production(C-D)	-49,530
3) Aggregated production result (1+2)	873,265
E) Other revenue and cost of production	*-48,096*
F) Result before taxes (3+E)	825,169
G) Income taxes	-25,823
4) NET INCOME (PROFIT/LOSS) FOR THE YEAR (F+G)	799,346
§ L) Growing stock increase	369,602
§ M) Quota Risky stands (avalanches/landslides)	-1,695
§ N) Quota unstable risky stands (wind)	-4,238
§ O) Quota risky stands of pinewood (fires)	-6,197
4) NET INCOME (PROFIT/LOSS) FOR THE YEAR ADJUSTED FOR PRIVATE HIDDEN VALUES (4+L+M+N+O)	1,156,817
Socio economic environmental *addenda*	
P) Recreational environmental benefits (unpaid)	8,16,701
Recreation (185.500 visits per year: Euro 3,098 per visit)	574,817
Watershed management services	391,345
Hunting surpluses	232,406
C-fixation	95,433
Fishing	15,494
Compensation for environmental services	-492,793
Q) Environmental damages - Pinewood fires	*-10,957*
Loss of fixed C	9,947
Loss of watershed management services	516
Loss of landscape quality	493
R) Result of environmental cost/benefit non monetary (P+Q)	805,744
NET INCOME (PROFIT/LOSS) FOR THE YEAR ADJUSTED FOR PUBLIC ENVIRONMENTAL IMPACTS (5+R)	1,962,561

Balance sheet

ASSETS	Euro
A) Fixed assets	120,885,135
B) Accruals	-2,013,623
Net assets (A+B)	118,871,512
§ Growing stock increase	369,602
Cash	4,356
Receivables	2,582
Total	11,924,8053
EQUITY AND LIABILITIES	
Debts	4,930
§ Stands risk accrual (avalanches/land slides/pests and other natural hazards)	169,540
§ Stands risk accrual (wind)	169,540
§ Stands risk of pine wood accrual (fires)	61,975
Total	405,985
Total equity	118,842,068
of which net income (profit/loss) for the year adjusted for private hidden values	1,156,817
Total equity and liability	119,248,053

Assets *satellite* accounts	
Fixed assets of natural capital	………..
Protection non forest area ha 614	………..
Protection forest area ha 2,490	………..
Nature reserves (protected biotope) ha 42	………..
Flora	………..
Rare species: e.g. *Cypripedium calceolus*	………..
Endemic species: e.g. *Wulfenia carinthiaca, Astrantia carniolica, Papaverum julicum*	………..
Fauna (n° of heads)	
Dears *(Cervus elaphus)*	1000
Roes *(Capreolus capreolus)*	1000-1200
Chamois *(Rupicapra rupicapra)*	1600
Steamboats *(Capra ibex)*	80
Grouses *(Tetrao urogallus)*	250-300
Black cocks *(Lyrurus tetrix)*	200
Small grouse *(Tetrastes bonasia)*	240-400
Ptarmigans *(Lagopus mutus)*	100
Lynches *(Felis lynx)*	3-4
Brown bears *(Ursus arctos)*	2-3

Equity and liability *satellite* accounts	
Net public assets including all environmental assets given to the enterprises by the society (protection and recreation forests, flora and fauna assets, etc.)	………..
of which flow of public environmental benefits	805,744

The fourth step of environmental accounting are taken into consideration all public impacts of the enterprise (table 9.4) estimated, whenever necessary, using environmental economics techniques like contingent valuation and travel costs able to deduce consumer surpluses or benefits variations. Positive items include recreation and watershed management considered in specific *addenda* to the income statement. Also hunting, fishing and carbon-fixation are included. In order to avoid duplication the public subsidies and compensation for these benefits are deducted. Amongst environmental damages of the enterprise is accounted the effect of forest fires. The net flow of non-market benefits, less damages, amounts to around 805,000 euro, therefore the total private and social profit of the enterprise is around 1,9 million euro.

In the assets balance sheet the environmental variables are accounted through satellite accounts which show natural resources received by the enterprise, without pricing them, but only quantifying in physical terms whenever possible.

As a synthesis of the environmental accounting methods various steps, figure 9.3 shows the evolution of the net income at the various environmental accounting steps. It is demonstrated how environmental consideration doubles the total income from 799,000 euro to 1,9 million euro.

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Figure 9.3 Income statement at the various steps of environmental accounting - Large Public Forest of Eastern Alps

A Large Lowland Public Farm

The second application of environmental accounting refers to a large public enterprise along the Adriatic coastland where conventional cereal and animal production create a certain negative environmental impact. Public management, however, also favours the production of environmental recreational services supporting the local tourist industry. Recent efforts have been carried out to prevent negative impact. Therefore, both conventional production and public environmental recreational activities are pursued. The latter are helped by a pinewood, other forest formations and wetlands, which improve the environment quality of the property. Also conventional agricultural production are assuming environmental connotations thanks to organic farming, quality products and the adoption of environmentally friendly techniques such as 'cover crops' extensification, hedgerows and set aside land acting as buffer strips to capture release nutrients. In particular the pinewood is being improved thanks to close-to-nature management. The same applies to wetlands, habitats, hedgerows and conservation of traditional countryside landscape.

As shown by figure 9.4 the conventional net result from the income statement is positive for some 150,000 euro, thanks to compensatory payments by the CAP equal to 180,000 euro. A remarkable level of conventional revenue must be, however, noted: animal productions for 1.6 million euro as well cereals and other crops for 445,000 euro. Other compensation should also be accounted such as those for organic farming (20,000 euro) and environmental enhancement including the buffer strips, the coastland pinewood, the hedgerows (28,000 euro), etc.

At the second step of environmental accounting (figure 9.4) it is interesting to see the distinction between the profit attributed to the conventional production equal to 163,000 euro, and the environmental one, amounting to a mere 23,000 euro. Amongst the latter are included the various subsidies and compensation for environmentally friendly farming, premiums for organic farming as well the highest prices compared to conventional production. Meanwhile, the cost takes into account environmentally friendly practices, the management of the buffer strips to prevent releases of nutrients, the other stewardship practices outside the ordinary management, the cleaning the pinewood frequented by visitors, etc.

The third step accounts for green manure practices, damages by deer, depreciation and insurance quotas and the effects of past negative impacts of certain farming practices. Therefore the adjusted net income shows how past intensive farming has created a certain environmental risk (figure 9.4) reducing the net income to 117,000 euro. Once the public benefits of the farm are considered, the increase of income (social) is remarkable reaching 464,000 euro (figure 9.4). These benefits include recreation, the positive environmental impacts of buffer strips felt outside the property, the positive good quality of the landscape due to conservation measures. All these values are added to the income statement as *addenda*, amounting, net of the related compensation, to 343,400 euro. Obviously it is a matter of estimation, however undertaken following the most suitable techniques developed by environmental economics.

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Figure 9.4 Income statement at the various steps of environmental accounting - Large Lowland Public Farm

A Medium Pre Alpine Private Farm

The third application is represented by a medium size dairy farm run as a family enterprise. It is located in the pre-Alps: one part on the slope (90 ha at an altitude around 1,000 m) and another on the bottom of the valley (10 ha at an altitude of 200 m) near a river bed. In general soil productivity of the area is rather low: meadows and pastures are often abandoned, but not in the case study farm. The soil near the riverbed is rather stony and permeable, and as a result less favoured for farming. But thanks to good management, the financial result is rather positive. Agritourism, quality milk and cheese processed on the farm, all in all, allow an acceptable income as shown in figure 9.5. The weakest point of the farm is given by an intensive cereal production in the lowland. It is necessary for providing the forage base, however, given the permeability of the soil, the intensive fertilisation and irrigation, a great release of nutrients has to be mentioned, nitrogen in particular.

In other words the farm has two different feature, a sort of Dr Jekill/ Mr Hyde: on the one hand it allows cultivation and stewardship of Alpine slopes providing very positive environmental landscape impact: on the other hand it severely pollutes the environment in the 10 ha of lowland near the riverbed. It should be underlined that the situation is far from being an isolate case being rather common in pre-alpine farming as underlined by the local recent Rural Development Programme (2000).

It is remarkable how the farm is able to internalise positive externalities thanks to an active agritourism, including hospitality and marketing of farm products and recreational activities. Meanwhile, the negative externalities are left to the public creating a kind of tragedy of the commons, given an ill defined 'right to pollute' the environment.

The story is well visualised by figure 9.5 showing a conventional net income of around 44,000 euro. The greatest size of the revenue is due to diary (around 88,000 euro), followed by agritourism - hospitality, meals and direct selling of cheese (33,000 euro) - then also other produces like ham (4,600 euro) and compensatory payments of stewardship have to be recorded.

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Figure 9.5 Income statement at the various steps of environmental accounting Medium Pre Alpine Private Farm

The difference between conventional product and environmental recreational ones (second step) is as follows: conventional products allow a revenue of 95,000 euro covering costs totalling 76,000 euro, and yelding a result of 19,000 euro (figure 9.5). Recreational environmental revenue amount to 66,000 euro with costs equal to 41,000 euro, allowing a remarkable result of 25,000 euro. The distinction between conventional and innovative recreation environmental products, is, however, difficult being interdependent. It is clear in fact that the diary is the key for multipurpose management representing the support to the other activities: agritourism (33,000 euro), quality cheese price premium value (20,000 euro), quality ham premium (4,650 euro), compensation of stewardship (5,160 euro) and sport facilities (1,550 euro).

The fourth step highlights the serious environmental problems created by the farm (figure 9.5). The farmer declares to be using 500 kg of nitrogen per hectare plus liquid manure. Recent analysis of Gren (1993 e 1999) estimated the cost to clean polluted water at around 5.5 euro/kg. Estimating a release of 300 kg/ha (may be also higher), the total one amounts to 3,000 kg., that is a total cost around 31,000 euro. This public cost, to be considered as *addenda* to the income statement severely affects the income (social) reduced to some 13,000 - 27,000 euro according to the price assumed for nitrogen pollution (figure 9.5).

The Small Horticultural Farm with high quality products

It is a small lowland pre-alpine enterprise, where wine and horticulture are the main activities. While grapes are mainly conferred to a local co-operative cellar producing quality appellation d'origine wine, a greatest part of the fruits, including apple, nasci, kiwi in addition to honey, and also bottled wine, are directly sold to consumers in a farm shop.

Buyers are well aware of the application of organic methods and can verify it during the shopping, therefore there is a willingness to pay a price premium for products that they consider of higher quality, and safer standard. Figure 9.6 shows a conventional net income of 38,000 euro obtained from a revenue of 139,000 euro and cost of 89,000 euro. Some 10,000 euro of financial costs should also be accounted.

The second step highlights that conventional farming yields a sharply lower net income - 4,000 euro with revenue of 81,000 euro and cost of 77,000 euro. Meanwhile environmental management of the enterprise (organic farming) allows the largest share of net income (48,000 euro with revenue of 58,000 euro and cost of 10,000 euro). There are various reasons for explaining the difference between of the two cost-centres: conventional and environmental one. Approximations and estimations have also been done. Nevertheless, it is clear that the highest revenue attributed to organic farming, is due to the image of the farm, the confidence of the consumers and their willingness to pay all the added value together with a price premium to the farmer directly (figure 9.6). In other words, the success is largely due the capability to produce in an environmentally friendly way, with cost similar, if not lower, than conventional farming, and to communicate this to the customers, therefore showing their satisfaction buying products sols in the farm shop.

It is interesting to see how the third and fourth steps do not significantly change the results, proving that the environmental qualities of the farm have already been internalised within the market.

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Figure 9.6 Income statement at the various steps of environmental accounting - Small Horticultural Farm with high quality products

9.5 Conclusions

Conclusions concern from one side the validity of the proposed method, from the other its capability to show and highlight the environmental effects of enterprise management.

The proposed methodology has certainly shown its capability to integrate environmental aspects into income statements and balance sheets. The stepwise approach allows a clear distinction between conventional and environmental/recreational productions as well as off-site and off-market effects. Private and public values can also be separated, making possible a development of accounting that reflects recent development of environmental economics in which the Total Value is made up by both market and non market values including: use, option and non-use (existence/heritage/conservation) values. The main methodological issue is given by reference points: that is thresholds benchmarks as outlined in figure 9.1. Once these benchmarks are defined and accepted the environmental accounting system can be rather easily built on the basis of conventional accounting as made for instance by RICA-FADN (Farm Accounting Data Network) created and supported by the European Union. In the specific cases analysed year environmental accounting has been made through interviews to farmers and extension service technicians during end year closing of book keeping. When farms and farm management is well known environmental accounting procedure do not need more than one day survey filling a specific questionnaire.

As far as the outcome of the proposed method is concerned it should be stressed that only major environmental effects typically related to agriculture and forestry, have been accounted for. One can see that, above all, use values have been incorporated within the various steps. Other values, meanwhile, and particularly option and non-use values have been rather neglected. Biodiversity, for instance, has not been accounted for. Nevertheless the method allow accounting also for these values when, and if, considered relevant and quantifiable.

One of the most relevant outcomes has been the possibility to show the major typical impact of farming and forestry under different situations and circumstances. For instance, the alpine forest property environmental accounting illustrates that many benefits are produced without market remuneration. In the coast farm, accounting shows the production of both positive and negative impacts, but with substantial overall success thanks to the adoption of modern environmentally friendly practices now gradually becoming the established norm in farming and forestry. The pre-alpine diary farm shows how benefits can be internalised through appropriate management, while also demonstrating of negative impacts that could be reduced under a more careful management and local authority control. Finally, the horticultural farm shows how positive impacts can be internalised thanks to appropriate management and marketing of quality products commanding a price premium and, at the same time, reducing negative impacts. All these effects being internal shows that financial accounting give result similar to economic (cost-benefit) account.

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Workgroup Session III: The EoI and FADN data for modelling/stakeholder analysis

Instructions

Task: Review the list of potential projects in the working package from the previous sessions, and add additional projects from the perspective of modelling with FADN data if needed. Make a stakeholder analysis with do's and don'ts for the total working package, with the following format.

Stakeholder	Contributes	Receives	Do's	Don'ts
Example: Farmer	Data on his farm	Money, Benchmark report	Provide useful information	Use more than 2 hours interview time
Researcher etcetera				

Group A
Working Package: Using new ICT opportunities to improve efficiency of current FADN systems

Group B
Working Package: Changing information requirements in FADNs as policy issues change

Group C
Working Package: Sharing data between different stakeholders like the regional, national and EU level, with effects on harmonising and conversion and a reduction in the administrative burden.

Group D
Working Package: Using improved data by better modelling for even better information products for farmers and policy makers

Group E
Working Package: Platform to bring professionals together to learn from each other, especially between old, new and potential EU members as well as with trading partners like the USA.

Groups for the workgroup session
The EoI and FADN data for modelling/stakeholder analysis

Group A - Using new ICT opportunities to improve efficiency of current FADN systems
A. de Cicco (chairperson)
K. Boone (reporter)
Z. Kubikova
I. Martini
H. Vrolijk
U. Toic

Group B - Changing information requirements in FADNs as policy issues change
G. Bonati (chair and reporter)
A. Karlsson
M. Merlo
A. Varendi
F. Arfini

Groep C - Sharing data between different stakeholders
C. Gundersen (chairperson)
V. Bratka (reporter)
P. Doria
M. Donati
A. Kinsella
B. Del'homme

Group D - Using improved data by better modelling for better information products
A. Povellato (chairperson)
B. Meier (reporter)
G. Lech
S. Schiavon
A. Fais
T. Borbas

Group E - Platform to bring professionals together to learn from each other
C. San Juan (chairperson)
M. Lekesova (reporter)
M. Aamisepp
A. Szelagowska
P. Nino

1. Hand computer III-A

Stakeholder	***Contributes***	***Receives***	***Do's***	***Don'ts***
Example: Farmer	*Data on his farm*	*Money, Benchmark report*	*Provide useful information*	*Use more than 2 hours interview time*
Researcher etcetera				
farmer	data	quality/fast	reliable	take more time
collector	ICT-knowledge	" "	user friendly	constanty changing
financing	money	...." "	keep promises	ask for more money
collector	time	additional info	educate	too complicated
user	methods	extra info	reliable info	no connection with other data bases
farmer	-	more feedback		

2. GPS.

III-B

Stakeholder	***Contributes***	***Receives***	***Do's***	***Don'ts***
Example: Farmer	*Data on his farm*	*Money, Benchmark report*	*Provide useful information*	*Use more than 2 hours interview time*
Researcher etcetera				
1. farmer	data	money	feedback	mix adm. stat.
2. government	financial suppl.	auditing data	tools	mix audit stat.
3. local gov	data	aggreg. data		
farmer	data	benchmark	explain	
4. EU	money	update		
policy maker	-	of ...		
farmer		less burden		

Researcher - imporves the quality of models
- models & scientific results

Consumer - traceability

III-C

Stakeholder	***Contributes***	***Receives***	***Do's***	***Don'ts***
Example: Farmer	*Data on his farm*	*Money, Benchmark report*	*Provide useful information*	*Use more than 2 hours interview time*
1. Researchers	methodology	links to experts	provide knowl-edge, publications	be too formal time consuming
2. -"-	fund ...	improve the speed data flow	convinced institut for use ICT	-
3. -"-	1.	1 + 2 + data, acces	1. + improve data quality, generate new data	pay for the data
4. policy makers	goals of DHSS, fi-nancing	results	should use the re-sults	don't want com-plicated answer

III-D

Stakeholder	***Contributes***	***Receives***	***Do's***	***Don'ts***
Example: Farmer	*Data on his farm*	*Money, Benchmark report*	*Provide useful information*	*Use more than 2 hours interview time*
Researcher etcetera				
Farmer	Data knowledge	* technical support	* provice feedback	* don't ask a question two times
		* markt position		
		* analysis		
		→ benchmarks	* limit number of farm visits	

Policy maker	* money * access to data in admin. * simplify regulation * define measurable goals	* more efficient use of public money	* realistic goals	don't be unrealistic

Stakeholder	***Contributes***	***Receives***	***Do's***	***Don'ts***
Example: Farmer	*Data on his farm*	*Money, Benchmark report*	*Provide useful information*	*Use more than 2 hours interview time*
Researcher etcetera				
Farmers	Data	Technical support comparison, certi-fication for credit, e-learning	fulfill database	int. must be chart and clear lose privicy
university and re-search center	models analysis	data	useful information the portal is clear and friendly	get individual data
policy makers	political program	data simulation of scenarios	they should make decision	they shouldn/t hesitate

10. The representativeness of the 1999 Spanish FADN survey

Ricardo Mora [1] Carlos San Juan [2] and José Eusebio de la Torre [3], Carlos III University Spain

10.1 Introduction

The Farm Accountancy Data Network (FADN) is a European Union (EU) farm-level survey widely used to analize policy impacts and the effect of changes in the level of producers protection. The survey is frequently used by researches and policy makers for calculating production, costs, and income of commercial agricultural holdings in the EU among other purposes. It provides valuable information on areas such as productive orientation and localization of the holdings, data which cannot be known from the results of the economic accounts of the agrarian sector. Guaranteeing that the survey is representative of the reality of the sector is a major priority.

Since 1986 the Spanish program of the National Farm Accountancy Network (RECAN from the Spanish acronym) has been integrated into the community FADN, adopting its methodology so that results obtained are, in principle, comparable to those from other EU countries.

However, sample sizes vary greatly among member states so that in order to obtain meaningful comparisons between aggregated results, the computation of sampling weights becomes an essential methodological issue. Furthermore, the complexity of the information gathered as well as the need to consider the active participation of the head of the holding implies that random selection is not a realistic sampling procedure. Both the rate of no response to the survey (in reality a simplified accounting of the holding) and the costs of obtaining the collaboration of a random sampling of agricultural business men and women would be quite high. For this reason, in practice, the sampling method has traditionally been based on the stratification of the field of observation.

The purpose of this work is to develop and implement a methodology to study how representative the 1999 Spanish RECAN sample is by using the recently released 1999 Agricultural Census data. We first propose a sampling design which maintains the advantages of the traditional stratification procedure and deals with well-known reported sampling problems in the RECAN survey. Then, we analyse how representative the actual 1999 RECAN sample is with respect to the 1999 Agricultural Census.

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10.2 The 1999 Agricultural Census for Spain

The source of population data used in the sampling design is the Spanish Agricultural Census for 1999. The target population in RECAN is the set of the commercial holdings [1], which is a sub-set of the target population in the 1999 Agricultural Census. The strata are defined by three characteristics: region, type of farming, and economic size. In order to design the sampling plan it is also necessary to focus our attention on the results on one or more characteristics or economic variables.

The design of the stratification involves unavoidable *a priori* decisions as to the definition of the cell. While the regional stratification by the Spanish NUTS-2 regions (Comunidades Autónomas) is desirable for sociological reasons, the definition of cells by farming type or economic size can be more difficult. In the following, we accurately define the cell that will be used in the design of the RECAN sample and the 1999 Agricultural Census variables used in the design of the plan for the RECAN sample.

10.2.1 Size classes

The concept of Standard Gross Margins (SGM) is used to determine the economic size of the farms, which are expressed as European Size Units (ESU). The SGM of a crop or livestock item is defined as the value of output from one hectare or from one animal less the cost of variable inputs required to produce that output. The SGM is calculated from three year averages on a regional level for more than 82 crops and livestock items. For 1999, the period of reference for the SGM corresponds to 1995, 1996 and 1997.

The economic size of the farms is calculated by multiplying the farm's hectares and Livestock Units by the corresponding regional SGM. The result, the Total Gross Margin (TGM) of the farm whether in pesetas, ECUs or Euros, can be expressed as ESUs by keeping in mind the fixed relation between the ECU and the ESU.[2]

In the typology used by the European Community, ten farm sizes are considered.[3] Given the target of defining cells as finely as possible, an attempt should be made to minimize the number of observations within each cell without jeopardizing the global

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[1] The definitions of commercial holdings, and therefore of the definition of the target population will be covered in more detail below.

[2] The value of the ECU by ESU has changed over time to reflect inflation, passing from 1,000 in 1980 to 1,200 in 1984. The exchange rate for conversion Pesetas/Euros is 167,119.

[3] These are: I (fewer than 2 ESUs), II (from 2 to fewer than 4), III (from 4 to fewer than 6), IV (from 6 to fewer than 8), V (from 8 to fewer than 12), VI (from 12 to fewer than 16), VII (from 16 to fewer than 40), VIII (from 40 to fewer than 100), IX (from 100 to fewer than 250), and X (more than 250 ESUs).

Table 10.1 Main variables by economic size units (ESU) 1999 agricultural census

(ESU)	Farms			Gross Total Margin			Utilised Agricultural Area (UAA)			Labour			Livestock		
	Number	a)	b)	ESU	a)	b)	Ha	a)	b)	AWU	a)	b)	TAU	a)	b)
[0,2)	781131	47.10		595220	3.83		1281246	5.26		234299	19.93		333635	2.22	
[2,4)	249442	15.04		718749	4.63		1157533	4.75		119911	10.20		369612	2.45	
[4,8)	224405	13.53	35.73	1284410	8.27	9.03	1974202	8.11	9.01	150644	12.81	18.34	800602	5.32	5.58
[8,16)	182756	11.02	29.10	2074915	13.35	14.59	3248939	13.35	14.83	181460	15.43	22.09	1633141	10.84	11.37
[16,40)	150483	9.07	23.96	3716363	23.92	26.13	6365798	26.15	29.06	210973	17.94	25.68	3284446	21.81	22.88
[40,100)	52458	3.16	8.35	3118411	20.07	21.92	5337838	21.93	24.37	121174	10.31	14.75	3555044	23.60	24.76
[100,250)	14068	0.85	2.24	2083549	13.41	14.65	2999781	12.32	13.69	71729	6.10	8.73	2730045	18.13	19.01
[250,∞)	3831	0.23	0.61	1947617	12.53	13.69	1978650	8.13	9.03	85534	7.28	10.41	2354219	15.63	16.40
Total	1658574	100.00	100.00	15539235	100.00	100.00	24343987	100.00	100.00	1175724	100.00	100.00	15060745	100.00	100.00

a) % overall farms; b) % farms under 4 ESU.

representation of the sample. However, an ambitious stratification design is in danger of not being implementable due to the high demands of collaboration which FADN imposes on the farmers. A compromise must be reached to solve this dilemma. Based on previous studies on the Spanish RECAN, a simplified farm size typology will be adopted in this study so that only eight size classes are considered: Extremely small (Fewer than 2), Verysmall (From 2 to fewer than 4), Small (From 4 to fewer than 8), Medium low (From 8 to fewer than 16), Medium (From 16 to fewer than 40), Medium high (From 40 to fewer than 100), Large (From 100 to fewer than 250), and Very large (More than 250).

The main difference with respect to the FADN farm size variable consists in the merging of types III and IV and also types V and VI. In our opinion, this simplification does not have a negative effect on the accuracy of the sample, as these categories are very densely populated and we assume that sampling can be very cost-effective in these strata. Table 1 shows the census distribution by size of the national totals of (i) number of farms, (ii) Total Gross Margin (TGM) in ESUs, (iii) Utilised Agricultural Area (UAA) in hectares, (iv) farm labour, in Agricultural Work Units (AWU[1]), and (v) livestock, in Total Livestock Units (LU).[2]

In the 1999 Agricultural Census, the total number of farms ammounts to 1,658,574 farms which exploit some 24,343,987 ha of UAA and 15,060,745 LUs, providing employment for 1,175,724 AWUs and generate a TGM of 15,539,235 ESU (the equivalent of 18,647,082,000 euro). Close to half of the farms (47.10%) do not reach 2 ESU of TGM, which in Spain and some other member countries is still the minimum TGM requirement defining a commmercial farm. Because of this, all farms appearing in the lowest size group in table 10.1 are currently not considered commercial. This large group of 'non-commercial' farms provides less than 4% (3.8%) of total TGM and exploit less than 6% of total UAA and less than 3% of LU, yet they absorb nearly one fifth (19.93%) of AWU, the majority of which is family labour.

More than half of the UAA (61.43%) and of LU (56.25%) fall within the group of medium-sized farms (8-16; 16-40 and 40-100 ESU). The TGM of this type of farm ammounts to more than half of the national total (57.34%). Finally, 43.68% of workers are employed by these farms. The large or very large farms (more than 100 ESU) use more than 20% of the UAA (20.45%) and more than 30% of LU (33.76%); their TGM represents 25.94% of the national total and they employ 13.38% of the total work employed by agriculture (measured in AWU). The smaller farms (from 4 to 8 ESUs) use around one tenth of land (8.11% of the UAA) and barely exceed 5% of the livestock (5.32% of the LU). Their TGM represents little more than 8% of the total (8.27% of the TGM). Scarcely more than one tenth of total work (12.81% of AWU) employed in agriculture is employed by this group of small farms.

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[1] An AWU is equivalent to the work of one person working full-time during one year.

[2] Agricultural holdings without an assigned type of Farming are excluded from the Table. In this case, the census assigns a Farming Type of 9999 and a TGM of 0. The north African enclaves are also excluded from the analysis. There are 48 farms in Ceuta and Melilla, of which 30 have a Farming Type of 9999 which implies a TGM of 0 and only 18 have a positive TGM.

10.2.2 Distribution of farms by regions

Table 10.2 shows the distribution of farms by Spanish Autonomous Communities according to the 1999 Spanish Agricultural Census. The three most extensive regions (Andalusia, Castilla-La Mancha and Castilla y León) are the ones which contribute the most to the total number of farms. This is, in part, due to differences in land size across regions. However, land size, number of farms, and other variables, do not always follow a simple relation. For example, Galicia, with less than 3% of national UAA, employs more than 16% of AWU despite only contributing 4% to the national TGM. Behind this lack of proporcionality lies the structure of agriculture in Galicia, characterized by a large number of small farms with an important participation of low-productivity underemployed labour.

Table 10.2 Main variables by region. 1999 agricultural census

Region	Farms		Gross Total Margin		Utilised Agricultural Area (UAA)		Labour		Livestock	
	Number	%	ESU	%	Ha	%	AWU	%	TAU	%
Galicia	239194	14.42	622545	4.01	674071	2.77	191189	16.26	1460863	9.70
Asturias	42117	2.54	177460	1.14	389056	1.60	40093	3.41	417028	2.77
Cantabria	16690	1.01	100606	0.65	190362	0.78	16720	1.42	311072	2.07
País Vasco	34294	2.07	148221	0.95	245268	1.01	27532	2.34	215658	1.43
Navarra	23229	1.40	324285	2.09	536931	2.21	16300	1.39	323502	2.15
La Rioja	16911	1.02	223127	1.44	151659	0.62	12846	1.09	113874	0.76
Aragón	73724	4.45	1038839	6.69	2133391	8.76	45953	3.91	1706099	11.33
Cataluña	73762	4.45	1110062	7.14	1016158	4.17	75103	6.39	2788476	18.51
Baleares	18857	1.14	124328	0.80	220335	0.91	12968	1.10	121721	0.81
Castilla-León	156982	9.46	2009867	12.93	5304079	21.79	99666	8.48	2375654	15.77
Madrid	14893	0.90	128437	0.83	350186	1.44	7993	0.68	144646	0.96
Castilla-La Mancha	182266	10.99	1674968	10.78	4433950	18.21	92095	7.83	1127163	7.48
Comunidad Valenciana	214367	12.92	1243210	8.00	705735	2.90	83992	7.14	569420	3.78
Murcia	55386	3.34	766947	4.94	449483	1.85	53427	4.54	541641	3.60
Extremadura	105796	6.38	966165	6.22	2806672	11.53	67856	5.77	1191396	7.91
Andalucía	355638	21.44	4622126	29.74	4673890	19.20	284816	24.22	1557653	10.34
Canarias	34468	2.08	258041	1.66	62760	0.26	47175	4.01	94882	0.63
Total	1658574	100.00	15539235	100.00	24343987	100.00	1175724	100.00	15060745	100.00

10.2.3 Type of Farming

Type of farming is defined following economic, not physical, principles. The EU has established a typology for types of farming which includes 17 principal classifications, subdivided into 50 special classes.

For a better stratification of the Spanish agriculture, we felt it convenient to group some of the principal EU types of farms into a single class while splitting others into different classes. As a result, 18 main types of farming are analyzed. The farming types and their corresponding EU codes are as follows: *Specialist cereals, oilseed and protein crops* (EU codes 1310, 1320, and 1330), *General field cropping* (1410, 1420, 1430, 1441, 1442, and 1443), *Specialist horticulture (not greenhouse)* (2011, 2013, 2021, 2023, 2031, 2033, and 2034), *Specialist horticulture (greenhouse)* (2012, 2022, and 2032), *Specialist vineyards* (3110, 3120, 3130, 3141, 3142, and 3143), *Specialist fruits and citrus fruits* (3211, 2312, 3213, 3220, and 3230), *Specialist olives* (3300), *Various permanent crops combined* (3400), *Specialist dairying* (4110, and 4120), *Cattle - combined* (4210, 4220, 4310, and 4320), *Sheep and goats* (4410, and 4430), *Sheep, cattle and other grazing livestock* (4420, and 4440), *Pigs* (5011, 5012, and 5013), *Fowl* (5021, 5022, and 5023), *Specialist combined granivores* (5031, and 5032), *Mixed cropping* (6010, 6020, 6030, 6040, 6050, 6061, and

Table 10.3 Distribution by region and type of farming of gtm. 1999 agricultural census

TYPE OF FARMING	TOTAL		PERCENT OF EACH AUTONOMUS REGION OF AGGREGATE MBT BY TYPE OF FARMING																
	GTM (ESUs)	%	Galicia	Asturias	Cantabria	País Vasco	Navarra	La Rioja	Aragón	Cataluña	Baleares	C. y León	Madrid	C. La Mancha	C. Valenciana	Murcia	Extremadura	Andalucía	Canarias
Specialist cereals, oilseed and protein crops	2114953	13.61	0.18	0.00	0.01	0.67	3.42	0.55	13.01	5.23	0.21	33.51	1.47	19.38	1.09	0.57	5.05	15.64	0.01
General field cropping	1230144	7.92	1.52	0.04	0.04	1.58	2.91	1.72	4.08	2.13	0.40	19.40	0.45	9.12	0.47	2.65	14.35	38.49	0.65
Specialist horticulture (not greenhouse)	537925	3.46	1.17	0.13	0.06	0.35	1.48	1.75	1.70	5.18	1.46	2.43	1.49	9.54	10.87	29.88	5.84	23.32	3.35
Specialist horticulture (greenhouse)	564295	3.63	1.42	0.25	0.46	0.39	0.24	0.04	0.19	2.47	0.41	0.29	0.30	0.94	4.05	13.73	0.35	65.47	8.99
Specialist vineyards	625010	4.02	1.28	0.00	0.00	2.33	5.31	14.30	4.50	10.66	0.06	5.59	0.68	31.97	9.52	3.10	5.54	4.75	0.42
Specialist fruits and citrus fruits	1723851	11.09	0.37	0.30	0.01	0.17	0.37	0.90	4.99	9.81	1.15	0.48	0.01	0.49	43.23	14.31	1.00	17.34	5.08
Specialist olives	2256424	14.52	0.00	0.00	0.00	0.00	0.04	0.03	0.34	2.17	0.30	0.16	0.37	4.00	1.27	0.14	2.66	88.51	0.00
Various permanent crops combined	583791	3.76	0.51	0.03	0.03	0.12	2.00	2.75	6.70	11.10	2.29	1.75	0.95	14.63	18.17	4.69	7.80	19.50	6.99
Specialist dairying	649001	4.18	39.82	12.20	8.43	4.81	3.15	0.36	0.68	5.25	1.71	8.50	1.39	2.46	0.74	0.77	1.16	7.79	0.80
Cattle - combined	517812	3.33	15.35	9.97	5.24	3.35	1.62	1.13	4.22	6.34	0.33	24.51	2.75	4.42	0.99	0.32	12.08	7.27	0.11
Sheep and goats	620562	3.99	0.82	0.20	0.20	1.74	2.93	1.51	6.74	3.64	0.34	28.96	1.09	25.45	1.93	2.28	9.18	11.29	1.70
Sheep, cattle and other grazing livestock	325188	2.09	4.58	5.96	2.90	4.20	3.32	0.58	6.80	3.26	0.65	27.14	1.56	9.85	1.60	0.73	14.33	11.93	0.60
Pigs	1106373	7.12	5.37	0.07	0.12	0.14	3.23	0.54	25.06	19.57	0.53	14.92	0.36	6.24	6.31	7.83	2.88	6.48	0.35
Fowl	160729	1.03	10.30	0.39	0.46	1.55	1.32	1.00	10.11	24.65	0.46	11.92	1.93	13.58	7.61	1.06	1.15	10.22	2.30
Specialist combined granivores	65975	0.42	10.69	1.17	0.82	2.39	1.34	0.98	9.60	35.97	0.40	6.13	0.05	9.94	8.09	1.85	1.24	8.43	0.92
Mixed cropping	1175114	7.56	3.14	0.19	0.02	0.35	3.67	2.17	5.40	4.92	1.76	5.35	1.34	20.66	4.19	3.83	8.66	32.89	1.46
Mixed livestock	386279	2.49	13.08	1.85	0.09	0.77	0.77	0.41	3.87	13.15	1.92	13.16	0.21	8.51	1.15	2.32	20.28	17.97	0.51
Mixed crops and livestock	895812	5.76	4.47	0.71	0.11	0.73	1.35	0.49	8.22	10.44	1.40	26.65	0.56	12.33	2.82	2.35	11.58	15.26	0.51

6062), *Mixed livestock* (7110, 7120, 7210, 7220, and 7230), *and Mixed crops and livestock* (8110, 8120, 8130, 8140, 8210, 8220, 8231, and 8232).

Table 10.3 shows the distribution of TGM by farming type in each Autonomous Region. Well known geographical specialization features can be highlighted by close scrutiny of the table: the concentration of olive trees in Andalusia, vineyards in Castilla-La Mancha, fruit and citrus in Valencia, horticulture in Andalusia, Murcia and Valencia, dairy cattle in Galicia, Asturias and Cantabria, and pigs in Castilla y León, Cataluña and Aragón. In general, regions tend to concentrate in one or two farming types: in Andalusia, for example, the highest percentage is found in olives, in Valencia and Murcia in fruits and citrus. Farming in Cataluña however, is more diversified among the defined farming types. Similar conclusions are obtained if we restrict the analysis to farms with TGM of 4 ESUs or more.

10.3 Sample size and sampling errors

Sample size can either be fixed exogenously, and therefore be considered as a constant, or it can be determined depending on a target on the significance level and/or a relative sampling error. As will be shown later, due to logistical limitations, the size of the sample for the RECAN survey cannot exceed a certain number, *n*, which should therefore be considered a pre-set constant. Nonetheless, we exploit the relation between sample sizes and relative sampling errors to distribute the sample of size *n* into two sumbsamples. In turn, this partition will provide us with a flexible tool for harmonising all of the restrictions that must be kept in mind when carrying out the sampling plan for RECAN.

For simplicity, we will develop a formula of a general nature. Consider a population of size *N*, divided into *H* cells of size H_h each. In this population we can take data from a statistical variable which we will call Y. Y_{hi} will be the value of *Y* for the element of the population *i-th* in cell *h*. Taking a sample of the population, we can estimate a characteristic of the distribution of the variable Y in the population.

We will concentrate on the total aggregate of variable Y across the population, **Error! Objects cannot be created from editing field codes.**. Given that the population is divided into cells, if we have a sample of size *n*, then we have n_h elements of the sample which pertain to the *h-th* cell. Therefore **Error! Objects cannot be created from editing field codes.**. In order to estimate Y_T, we use the weighted mean: **Error! Objects cannot be created from editing field codes.** where **Error! Objects cannot be created from editing field codes.** is the probability that the element of the *i-th* population of cell *h* pertains to the sample of nh units obtained in the h-th cell. If we supposed that **Error! Objects cannot be created from editing field codes.**[1], meaning that the elements of the population are selected using a simple random sampling without repositioning within cell h, then **Error!**

[1] As will be seen later, this quotient receives the name of elevation factor.

Objects cannot be created from editing field codes. where **Error! Objects cannot be created from editing field codes.** is the average sample of Y in the *h-th* cell. **Error! Objects cannot be created from editing field codes.** is an unbiased estimator with variance equal to **Error! Objects cannot be created from editing field codes.**, where **Error! Objects cannot be created from editing field codes.** is the population quasi-variance of the variable Y in the cell *h-th*.

Our objective is to calculate the sample size so that **Error! Objects cannot be created from editing field codes.**, where *r* is the maximum admissible relative error and **Error! Objects cannot be created from editing field codes.** is the level of significance. If we suppose that **Error! Objects cannot be created from editing field codes.** follows a normal distribution or, as is the case, that the sample size is large, then we can calculate the optimal sampling size *n* based on the earlier formula for a given value of *r* and **Error! Objects cannot be created from editing field codes.**.

To see this, note that since **Error! Objects cannot be created from editing field codes.** follows a normal distribution, then **Error! Objects cannot be created from editing field codes.** follows a distribution N(0,1). Therefore **Error! Objects cannot be created from editing field codes.** and **Error! Objects cannot be created from editing field codes.**.

As mentioned earlier, Z is a *N(0,1)*, so that if *FN(0,1) (x)* is the function of distribution of a random variable with distribution *N(0,1)*, then **Error! Objects cannot be created from editing field codes.**, which implies that **Error! Objects cannot be created from editing field codes.**. Let us define **Error! Objects cannot be created from editing field codes.** so that **Error! Objects cannot be created from editing field codes.**. Substituting **Error! Objects cannot be created from editing field codes.** for its value:

Error! Objects cannot be created from editing field codes.

Calling **Error! Objects cannot be created from editing field codes.**, then:

Error! Objects cannot be created from editing field codes.

Solving for *n* from the earlier equation, gives the desired sample size:

Error! Objects cannot be created from editing field codes.

Now, if the design feature of the sample is of minimum variance then **Error! Objects cannot be created from editing field codes.**. Thus, substituting in the formula for *n*, the expression for the size of the sample simplifies to:

Error! Objects cannot be created from editing field codes.

Now we can customize the earlier formula for the chosen clusters:

Error! Objects cannot be created from editing field codes. (1)

Where:

Error! Objects cannot be created from editing field codes. is the quantile of order **Error! Objects cannot be created from editing field codes.** in the distribution N(0,1).

$V(Y_{jhk})$ is the population quasi-variance of the variable Total Gross Margin, within the cluster defined by the size class k ($k = 1, 2, \ldots, M_{jh}$) the farming type h($h = 1, 2, \ldots, Tj$) within the region j (j = 1, 2, …, 17).
Y_T is the total population of the variable Total Gross Margin.
r is the maximum admissible relative error.
N_{jhk} is the number of farms in the field of observation of class k, within the farming type h and belonging to region j.

Equation (1) can be used to determine the approximate sample size needed to estimate the variable of reference (the national Total Gross Margin) with a fixed degree of precision. It must be born in mind that this is a valid approximation to the extent to which the sampling is random within each cell.

With a stratified random sampling and large samples, the maximum relative error in the estimation of the total of the variable studied in region j, with Farming Type h and size class k, is approximated by the formula from the normal distribution:

Error! Objects cannot be created from editing field codes. (2)

in which:
r_{jhk}: denotes the maximum relative error which can be expected, with a probability **Error! Objects cannot be created from editing field codes.**, in the estimation of the total of variable Y in the cell *jhk*.
N_{jhk}: denotes the number of farms in the field of observation belonging to a region j (j = 1, 2, …, 17), farming type h($h = 1, 2, \ldots, T_j$) and size class k ($k = 1, 2, \ldots, M_{jh}$).
Error! Objects cannot be created from editing field codes.is the sampling rate within the region j (j = 1, 2, …, 17), farming type h($h = 1, 2, \ldots, Tj$), and size class k ($k = 1, 2, \ldots, M_{jh}$).
n_{jhk}: denotes the size of the sample in cell *jhk*.
$V(Y_{jhk})$: denotes the population quasi-variance of the variable being studied in the cell *jhk*.
Y_{Tjhk}: is the total of the variable being studied in the cell *jhk*.
Error! Objects cannot be created from editing field codes. is the quantile of the order **Error! Objects cannot be created from editing field codes.** in the distribution $N(0,1)$.

Equation (2) is quite useful because it provides an estimator for the relative errors by stratum for a given sampling design. Since the representativeness of the sample by regions has a special relevance for sociological reasons, it is interesting to adapt Equation (2) for the case of the estimation of regional TGM. In this case, the sampling error in the region j is **Error! Objects cannot be created from editing field codes.**and the total for the country is **Error! Objects cannot be created from editing field codes.**where Y_{Tj} represents the total of the variable of the study in the region j and Y_T is the total of the variable of the study for the country as a whole.

The above formula assumes that the estimator of interest is unbiased. This is unwarranted if some cells remain without surveyed observations. In this case, the above formula would underestimate the real relative sampling error, even in those cells for which there are data. This is relevant in our study case since, as it will be seen below, various cells will be considered irrelevant in our sampling design, imposing an additional restriction on the field of observation in the RECAN. If we are merely interested in the new field of observation, then the above formulas are still valid.

However, if we are interested in the field of the RECAN before considering those cells to be irrelevant and we would like an evaluation of the discrepancy between the estimations of the RECAN and the parameter to be estimated since we considered those cells irrelevant, then it is necessary to correct for the bias in the estimator. This formula will also be valid for evaluating the real RECAN sample in case there are cells for which there are no observations.

For simplicity, we will develop a formula of a general nature. Its application to each case of interest is straightforward. Suppose that there are M cells for which there are no observations in the cell and the elevation factor is therefore not defined. This implies that the estimator **Error! Objects cannot be created from editing field codes.** is biased. Let Y_{T1} be the average of the estimator of Y_T in the presence of the bias and let Y_{T2} be the aggregate of the variable in the cells for which there are no observations, then: $Y_T = Y_{T1} + Y_{T2}$. We are interested in knowing the relative sampling error as a function of the various groups defined by size, region, and farming type. In the case, since the average of **Error! Objects cannot be created from editing field codes.** is not Y_T, from the definition of the relative sampling error it can be shown that

Error! Objects cannot be created from editing field codes. (3)

The second term of the right-hand part of the above equation indicates the percentage of the variable of interest which lies out of reach ($Y_{T2} = Y_T - Y_{T1}$). This equation tells us that if there are cells with no observations in the sample, then the relative sampling error is equal to the relative error that is committed in the cells with sample plus the proportion of the variable of interest found in the cells with no sample.

10.4 The sampling design methodology

In this section, the methodological choices needed to implement the sampling design and the evaluation of the actual 1999 RECAN survey are described. First, we define the field of observation of the RECAN. In particular, we propose a minimum size for a farm to be considered commercial and we also identify strata to be considered irrelevant in the sampling. Finally, we look at restrictions on the sampling plan imposed for practical purposes and set up the algorithm that aims at guaranteeing that all restrictions are fulfilled.

10.4.1 Minimum Farm Size

The target population of the FADN is the grouping of commercial farms in the EU of at least one hectare and/or those with less than one hectare which commercialise a specific quantity (which differs among Member States) of their production.

In order to define commercial farms, the Commission follows directives specified in Regulation 79/65/EEC and the subsequent modifications and adopts a pragmatic approach based on the economic significance that the farm has for its owner. In particular, a farm is considered commercial when it is large enough to provide a sufficient income level to maintain the farmer and his or her family. Consequently, to be considered commercial, the farm must exceed a minimum economic size expressed in ESU. In Spain, the established limit is 2 ESU, which implies that all farms with a TGM of more than 2 ESU have been included in the target universe of the RECAN.[1] For 1999, this limit is questionably low.

The 1989 Spanish Agricultural Census shows that farms with fewer than 2 ESU made up 63.40% of the total, their TGM was 9.5% and the UAA was 11.4%. As far as labour and livestock items are concerned, the figures were 26.40% and 4.9% respectively. This means that in the ten years between 1989 and 1999, there has been a significant reduction in the importance of farms with fewer than 2 ESU in Spain. This structural change in the behaviour of Spanish agriculture suggests the need to revise the lower limit for economic size of a commercial farm for two reasons. First, an increase in prices in the Spanish economy has meant that the purchasing power of income from farms with fewer than 2 ESU has dropped dramatically, raising serious doubts as to whether it is realistic to suppose that farms of 2 ESU can guarantee a sufficient economic level to sustain an average Spanish family, even in rural areas. Second, general price increases in the products have affected the intertemporal comparisons of TGM. Farms which were formerly considered non-commercial in 1989 will now fall into the category of commercial farms using the new SGMs calculated from the 1995, 1996 and 1997 RECAN surveys.

The census information reveals that the proportion of farms with fewer than 4 ESU in 1999 (62.14%) is very similar to the proportion of farms with less than 2 ESU in 1989 (63.4%). As far as the TGM is concerned, the corresponding figure for farms with fewer than 4 ESU in 1999 is 8.46% whilst the figure for farms with less than 2 ESU in 1989 is 9.5%. For the UAA, the comparison would be 10.01% compared with 11.4%. In the case of AWU and LU, the figures are 29.43% compared to 26.2 and 4.67% compared to 4.9% respectively.

In the 1999 Agricultural Census, accountancy data was collected from 1,658,574 farms.[2] A lower limit of economic size of 2 ESU of TGM would exclude 781,131 farms and the RECAN universe would consist of 877,443 farms with a TGM of fewer than 2 ESU. The sample size of the 1999 RECAN was 8,233 farms[3] of which 25 had a TGM strictly inferior to 2 ESU and, hence, only 8,208 farms would be considered commercial. This figure implies an average weight in the 1999 RECAN sampling of 106.9.

If the lower limit of the TGM for a commercial farm is 4 ESU, the 1999 RECAN universe would include only 628,001 farms. The 1999 RECAN survey has 8,080 farms with 4 or more ESU, which would imply an average sampling weight of 77.72.[4] This new

[1] This threshold varies greately across countries: Holland has established its limit at 16 whilst in Belgium is 12 ESUs. Austria, Denmark, Finland, France, Germany, Luxembourg, Sweden, and the UK (except N. Ireland) have all set the limit at 8 ESUs. Northern Ireland has the limit at 4 and Greece, Ireland, Italy and Spain at 2. Finally, Portugal has the limit at 1.

[2] Farms without a Farming Type (code 9999 in the Farm Return) and farms in Ceuta and Melilla were excluded.

[3] This quantity compares favourably to sample sizes from many other Member States. The average number of observations in the FADN sample over the last few years in Belgium has been 1,196 observations, in Denmark 2,117, in Germany 5,827, in Greece 4,834, in France 7,568, in Ireland 1,202, in Italy 16,235, in Luxembourg 278, in Holland 1,516, in Austria 2,085, in Portugal 2,932, in Finland 1,007, in Sweden 827 and in the United Kingdom 3,648.

[4] The average weight of a farm in the FADN sample in Belgium over the last few years has been 37, in Denmark 25, Germany 50, Greece 100, France 54, Ireland 106, Finland 48, Sweden 49 and in the United Kingdom 37. Note how, in general, the more restricted the definition of a business is, the lower its average weight tends to be in each observation.

lower limit leads us to a new definition of a commercial farm. As shown in table 10.1, the 628,001 farms with more than 4 ESU of TGM contribute more than 89% to the national TGM, to national UAA and to LU, and nearly employ 70% of AWU.[1]

For these reasons, and with the previously mentioned goal to reduce the number of cells under consideration and, thus, handling the management of the sample without harming its representativeness, we restrict the field of observation by subtracting from the 1,658,574 farms in the Census those without a farming type and farms whose TGM is less than 4 ESU.

In this way, the target universe is made up of 628,001 farms with more than 4 ESU of TGM according to the 1999 Agricultural Census. Although the proportion of farms with fewer than 4 ESU is very high in all regions (with values ranging from 44.62% in Cataluña to an astonishing 84.38% in Galicia), this class of farm contributes little to regional TGM and employs a small proportion of the available resources, with the exception perhaps, of Galicia, where it accounts for 25.7% of TGM.

10.4.2 Irrelevant cells

In order to define the field of observation, it is also necessary to identify cells considered to be irrelevant for the purpose of the survey. We proceed following previous studies and practices in the RECAN design and assume a farming type to be irrelevant in a region if its TGM represents less than 1% of the regional TGM. All of the cells which fulfill this condition are outside the field of observation of the RECAN. Following this criterion, the farming types considered irrelevant by region are presented in figure 10.1.

It is important to point out that the exclusion of irrelevant farms from the sample does not substantially alter the coverage rate of this group's commmercial farms.

Finally, table 10.4 shows the number of cells by Autonomous Region and the number of observations in each cluster that fulfil the three following conditions: (a) each observation represents one commercial farm, i.e. a farm with TGM in excess of 4 ESU; (b) all cells are relevant, i.e. they represent farming types which contribute to regional TGM in excess of 1 percent; and (c) cells for which the 1999 Agricultural Census does not record any farm are also excluded. To sum up, the proposed 1999 RECAN universe is formed by 612,921 farms distributed across 1,195 strata or cells.

[1] Of course, the proportion is lower if we consider salaried labour since it is concentrated in farms with greater economic size.

Region	Farming Types exclude as irrelevant
Galicia	Cereals, oilseed and protein crops (except rice); Horticulture (except greenhouse); Horticulture in greenhouse; Vineyards; Fruit and Citrus; Olives; Various permanent crops combined; Sheep and Goats; Mixed cropping
Asturias	Cereals, oilseed and protein crops; Various crops combined; Horticulture (except greenhouse); Horticulture in greenhouse; Vineyards; Fruit and Citrus; Olives; Various permanent crops combined; Sheep and Goats; Pigs; Fowl; Various granivores combined; Mixed cropping
Cantabria	Cereals, oilseed and protein crops; Various crops combined; Horticulture (except greenhouse); Horticulture in greenhouse; Vineyards; Fruit and Citrus; Olives; Various permanent crops combined; Sheep and Goats; Fowl; Various granivores combined; Mixed livestock; Mixed crops and livestock
Basque Country	Horticulture (except greenhouse); Various permanent crops combined; Mixed livestock
Navarra	Horticulture in greenhouse; Olives; Fowl; Various granivores combined; Mixed livestock
La Rioja	Horticulture in greenhouse; Olives; Sheep and Cattle + various grazing livestock; Fowl; Various granivores combined; Mixed livestock
Aragon	Horticulture (except greenhouse); Horticulture in greenhouse; Olives; Dairy cattle; Various granivores combined
Cataluña	Sheep and Cattle + various grazing livestock
Baleares	Vineyards; Fowl; Various granivores combined
Castilla y León	Various granivores combined; Horticulture in greenhouse; Fruit and Citrus; Olives; Various permanent crops combined; Fowl; Various granivores combined
Madrid	Fruits and Citrus; Various granivores combined; Mixed livestock
Castilla - La Mancha	Horticulture in greenhouse; Fruit and Citrus; Various granivores combined
Valencia	Various crops combined; Dairy cattle; Beef and mixed cattle; Sheep and Cattle + various grazing livestock; Various granivores combined; Mixed livestock
Murcia	Olives; Dairy cattle; Beef and mixed cattle; Sheep and Cattle + various grazing livestock; Fowl; Various granivores combined
Extremadura	Horticulture in greenhouse; Dairy cattle; Fowl; Various granivores combined
Andalusia	Vineyards; Beef and mixed cattle; Sheep and Cattle + various grazing livestock; Various granivores combined
Canarias	Cereals, oilseed and protein crops; Vineyards; Olives; Beef and mixed cattle; Sheep and Cattle + various grazing livestock; Various granivores combined; Mixed livestock

Figure 10.1 Irrelevant farming types by autonomous region

Table 10.4 Number of cells in the proposed 1999 sampling universe by autonomous region

Region	Number of Cells	Number of Farms in 1999 Census
Galicia	53	35,546
Asturias	31	11,987
Cantabria	28	6,328
País Vasco	73	7,161
Navarra	75	11,650
Rioja	69	8,981
Aragón	78	37,403
Cataluña	101	40,475
Baleares	82	5,428
Castilla-León	65	76,115
Madrid	85	5,074
Castilla-La Mancha	90	65,801
Valencia	70	64,262
Murcia	71	19,727
Extremadura	84	33,252
Andalucía	78	174,152
Canarias	62	9,579
Total	1,195	612,921

10.4.3 Restrictions in the sampling design

Given the sample size and one method for assigning a quota to each cell, it is straightforward to compute an *unrestricted* sampling design. In practice, this design will not be fully implementable for a variety of reasons which we discuss below. However, an implementable sampling design can be obtained after imposing several restrictions to the design process. We propose an iterative algorithm which has two stages at any given step. In the first stage, we obtain *unrestricted* quotas for each cell. In a second stage, we obtain *restricted* quotas by sequentially imposing a pre-set number of restrictions/conditions that our design should follow.

Looking for a compromise between the best sampling design and its implementability, a number of restrictions have been considered. These restrictions are based on experience obtained through data collection in earlier editions of the RECAN, impositions from the EU to ensure quality of the data, and budgetary constraints. The first restriction to consider is that the sample size is bounded due to budget considerations.

Restriction 1

The total number of farms in the sample must be less than or equal to 9,500.

The experience of earlier editions of the RECAN indicates that farms of a large economic size are difficult to sample. Accountancy agencies have, over the years, been unable to obtain collaboration for many large size farms. The year under study, 1999, was no exception. This situation leads us to propose the following.

Restriction 2

The number of farms in the RECAN sampling plan with more than 250 ESU must be fewer than or equal to 350.

In order to ensure the quality of estimations, the FADN requires that the elevation factor of the farms should not be greater than 500.

Restriction 3

The ratio between the number of existing farms and the number of farms in the RECAN sample must be less than or equal to 500 in each stratum.

In previous RECAN sampling designs, two additional restrictions had been included ex-post: (i) the minimum number of farms in a cell is set to 5, and (ii) the maximum number of farms in a cell has to be 50. The minimum of 5 was chosen in order to ensure a representative minimum for all cells being considered whilst the choice of 50 as upper limit was taken on the assumption that a greater sample size would not improve significantly the precision of the estimations but could increase the cost of the survey. These restrictions are not without serious problems. First, in a significant number of cases there are less than five farms in a cell. Then, the design would imply to sample farms in excess of all existing farms in the cell, so that the sampling quota would be over 100%. Second, the maximum bound does not prevent this problem to appear also in large cells so that it is perfectly possible to have less existing farms than those assigned in the design and still satisfy the upper boundary. An obvious solution to these problems is to impose the following restriction in the design.

Restriction 4

The number of farms in the RECAN sample must always be smaller or equal to the number of existing farms.

However, the limits of 5 and 50 still imply a practical problem as they are incompatible with Restriction 2. To see this, consider that there is a total of 77 relevant cells with strictly fewer than 5 existing farms and with more than 250 ESU, which add up to a total of 169 existing and, thus, assigned farms. On the other hand, there are 89 cells with 5 or more existing farms with more than 250 ESU. If there must be a minimum of 5 farms in the sampling plan in each cell, then we have, at least, a total of 5 x 89 = 445 farms for this group. This means a total of 614 farms to be surveyed, a number which violates Restriction 2.

A direct solution consists of relaxing the lower limit, at least for farms of more than 250 ESU. According to this, it is straightforward to compute the number of farms in the sample with more than 250 ESU if the minimum number of farms by cell is lowered successively to: 4, 3, 2, or 1. If we set 4 as a lower bound: 105 + 4 105 = 525. If 3 is the lower bound: 72 + 3 116 = 420. If it is 2: 28 + 2 138 = 304. Finally, with 1, we have 28.

It turns out that Restriction 2 is only compatible with a minimum number of 2 or 1. For the sake of improving accuracy at the lowest cost, we set the minimum number to 2 and extend it to those cells in which there are farms with fewer than 250 ESU to avoid a bias in the representativeness of the cells with assigned numbers between 2 and 5. Then, the last restriction becomes.

Restriction 5

The number of farms in a cell must belong to the interval:
[min{2, existing farms}, min{50, existing farms}].

Therefore, restrictions 1 to 5 are applied to the *unrestricted* design in the following section to develop the RECAN sampling plan.

10.4.4 Choice of quota assignment method

Several methods can be used to assign a quota to each cell or stratum. Amongst them, we will consider the following two: the minimum variance method and the proportional method. The first one identifies the assignment which minimizes the variance of the target estimation, in our case, national TGM. In general, if the objective of the RECAN were to estimate the aggregate TGM only, the method of minimum variance would be the 'ideal' method. Although the estimation of the aggregate TGM is an important goal, the RECAN survey also pursues other goals. For example, RECAN gives detailed information on labour requirements at farm level. As productivity differs widely between farms of different size, it seems that a minimum variance method based on national TGM will underemphasize the need to sample strata with low production levels and large labour requirements.

It is theoretically possible to propose an assignment method which minimizes the variance of, for example, a linear combination between TGM and AWU. However, in practice, this strategy will always reduce to an *ad-hoc* proposal of a trade off between the variance of TGM and the variance of AWU. These *ad-hoc* choices can become even more controversial if we are willing to consider more than two variables, as it is the case for the RECAN survey.

The proportional method assigns quotas such that the ratio between the number of farms in the sample and the number of farms in the population is approximately constant. This is, therefore, an extremely straightforward method that does not require ad-hoc assumptions on the objectives of the survey. In fact, the proportional method may prove very effective if the variables of interest, no matter which ones and how many, show little variance across cells. However, it becomes less and less reliable if the dispersion of variance across cells is very important. In particular, if variance changes according to size, so that large farms have less variance in, say farm TGM, the proportional method will tend to overemphasize sampling in precisely those strata for which RECAN has traditionally been less successful: the very large farms.

For these reasons, we propose an intermediate simple solution which consists of assigning, for each cell, the average between the minimal variance quota and the proportional quota.

10.4.5 The algorithm for quota calculations

It is possible to compute *unrestricted* assigned quotas using both the minimum variance method and the proportional method. An *unrestricted* average method would simply consist of the average between the previously computed two assignments in each cell using the 1999 Agricultural Census data. This procedure, however, does not satisfy restrictions 1-5 and the result is, therefore, not satisfactory.

An ideal way to ensure that restrictions 1-5 are met would be to find the assignment that minimizes the variance of the estimator of the aggregated TGM, subject to restrictions 1-5. This strategy is not implementable as it implies a complex nonlinear problem with an enormous number of variables (one for each defined cell). Furthermore, it does not solve the above-mentioned problem of compromising amongst multiple objectives. For this reason, a different strategic line will be followed so that the sampling plan closely verifies restrictions 1 to 5 and the average method is implemented.

First, the RECAN target population is divided into two subpopulations: farms with strictly fewer than 250 ESU and farms greater than or equal to 250 ESU. These populations shall be referred to as SP1 and SP2, respectively. At this stage, the total sample size is 9,500.

We start by setting a significance level and a relative sampling error for each subpopulation. The level of significance and the sampling error depend on the sample size of the two subpopulations as shown in Equation (1). Thus, we can minimize the admissible relative error subject to restrictions 1 and 2 by choosing a partition of the total sample into the two subpopulations.

Once we have obtained the sample size for SP1 and SP2, we calculate the quotas following the minimum variance and proportional methodology and, using those results we obtain the initial quota using the averaging method.

Of course, restrictions 1 and 2 are already met but restrictions 3, 4 and 5 are not. Given a set of assigned quotas, we are going to implement at any step of the algorithm a sequential testing procedure which gives predominance to restriction 5. We start by checking whether the quota is lower than two. If this is case, we set the quota to 2. If it is not, then we keep the quota unchanged. Then we see whether the quota is smaller than the number of existing farms. In the positive case, we leave the quota unchanged. If the answer is negative, then we set the quota equal to ¼ of the number of existing farms. Finally, we check whether the quota is smaller or equal to 50. If this is the case, we leave it unchanged. In the opposite case, we fix it to 50. The final quota assigned is the resulting quota rounded off to cero decimal digits.

We check whether restrictions 1, 2, 4, and 5 are met. If that is case, the algorithm is finished. Otherwise, we must first ensure that restrictions 1 and 2 are met. When they are not met, we recalculate the sample size of the two populations by using a search grid and marginally changing the different relative sampling errors. In general, the relative sampling errors vary inversely with the size of the sample. Thus we choose the smallest increase or decrease in the relative sampling error so that restrictions 1 and 2 are met in the new partition.

Once we have this new partition, we can procede with the algorithm. Although it is not possible to establish convergence, a fundamental advantage of the proposed algorithm is that it is very simple to implement. In our application to the design of the 1999 RECAN sample, a solution was reached in the second step. However, note that restriction 3 is never imposed thoughout the algorithm. As will be seen below, after the algorithm was implemented, restriction 3 was satisfied in all but two cells (that is, in 1,193 out of 1,195 cells). We feel that this does not affect the quality of the design as we will argue in the next subsection.

10.5 The sampling design results

10.5.1 Summary of results

The relative sampling errors of the sampling design satisfying the restrictions are 0.43% for SP1 and 15.00% for SP2, resulting in a sample size for the whole population of 9,485 farms and for the subpopulation of 250 ESU or more a size of 349 farms. The relative sampling errors were set to be as near as possible to the maximum of farms permitted for the whole population and the subpopulation SP2. It can be seen that for SP1, the relative sampling error is quite low, while for SP2 it is high. This is due to the fact that 349 farms is a very low number to be able to get a small relative sampling error.

By class size, the Medium class strata receives the highest quota (2,387 farms, 25.17% of the total sample size), while the Very Large class is assigned the smallest quota (349 farms, 3.68% of the total). By region, the plan assigns the highest quota to Andalusia; 1,816 farms (19.15% of the total), followed by Castilla-La Mancha (1,138 farms) and Castilla y Leon (1,095). Inversely, Cantabria is the Region with the lowest quota (125 farms). By farming type, the highest is assigned to *Cereals, oilseed and protein crops* (1,244 farms or 13.12% of the sample), a coherent number given that its contribution to national TGM for commercial farms as a whole in Spain is 14.14%. The smallest quota goes to *Various granivores combined*, with only 41 farms. This is mainly due to the fact that this farming type is only relevant in three Regions: Galicia, The Basque Country and Cataluña.

The average elevation factor is 66.21%. By size classes, the elevation factor averages decrease from 118.98 for the Small class down to 10.98 for the Very Large class. By farming types, the largest average is obtained for *Olives* (218.18). This is due to the fact that the number of farms by cell is restricted to be equal or smaller than 50, and farms in *Olives* tend to vary hugely in size, with the presence of some very large farms with volatile TGM. Although the sampling plan assigns the largest quota available (50), elevation factors still remain high. By region, the elevation factors are on average smaller than 100 except in Valencia (104.79). The lowest average is obtained for Madrid (26.34).

In general, the elevation factors are below the limit of 500 established by the EU. Table 10.5 offers a brief summary of the distribution of the elevation factors by cells. There are 5% of cells with an elevation factor of 1, which means that all farms belonging to these cells must be sampled. Only 1% of the cells show an elevation factor greater than 127.34.

As already mentioned, restriction 3 is not fulfilled in two cells. These cells are: (I) Andalusia, *Olives*, Small (with an elevation factor of 758.16); and (II) Andalusia, *Olives*, Medium low (with an elevation factor of 515.98).

The problem arises simply because the required maximum number of farms is simply too restrictive. There are 37,980 and 25,799 existing farms in the two cells respectively. Thus, restrictions 3 and 5 are incompatible in these two cells. We give priority to restriction 5, but note that given the current sample size, it would always be possible at least to fix quotas of 63 (37,980/500≅76) and 52 (25,799/500≅52) for the two cells. Of course, the effect on the relative errors for national TGM is negligible.

Table 10.5 Distribution percentiles of the elevation factors in the proposed sampling plan by cells

Quantiles (%)	Elevation Factors
1	1
5	1
10	2
25	9
50	25.5
75	64
90	84
95	88.36
99	127.34

10.5.2 Relative sampling errors

One way of evaluating a sampling plan is through the calculation of the relative sampling error, meaning the largest percentage deviation between the estimation of national TGM from its real value given a significance level.

Equation (2) is an approximation which does not take into account the missing information in the irrelevant (*a priori* not surveyed) cells. If we wish to consider the discrepancy due to the irrelevant cells, then Equation (3) is a better approximation. Both approximations will be more accurate when sampling is random within cells and large samples justify the assumption of normality of the TGM estimator. Our opinion is that these equations, in particular, Equation (3) are well justified in this context. The RECAN sample is a random sample within the universe of non-irrelevant farms which are willing to collaborate. The controversy then is simply whether the strata are sufficiently detailed to avoid biases due to lack of collaboration within the cell. As already discussed, this is unlikely to be a serious problem since farm size is a major predictor of lack of collaboration, and size has been partitioned into a significant number of categories. On the other hand, the large overall sample - over 9,000 observations - implies that the normality assumption is perfectly reasonable.

Note that relative sampling errors were set in order to obtain the sampling plan. These errors are established before filtering the quotas by the algorithm. Thus, the new reassignment obtained through the algorithm will result in relative errors different (generally greater) than the pre-assigned ones. We compute theoretical sampling errors for the design

Table 10.6 Relative errors by autonomous region

Region	Relative errors at relevant cells (%)	Relative errors at all cells (%)
Galicia	4.82	8.78
Asturias	5.20	9.21
Cantabria	4.46	8.74
País Vasco	4.02	6.30
Navarra	4.52	6.87
La Rioja	4.35	7.32
Aragón	5.54	7.82
Cataluña	4.62	5.57
Baleares	4.15	5.30
Castilla-León	3.17	5.61
Madrid	4.63	5.39
Castilla-La Mancha	3.89	5.00
Comunidad Valenciana	11.56	14.34
Murcia	17.90	19.73
Extremadura	5.06	6.40
Andalucía	4.60	7.28
Canarias	22.10	24.20
Total	2.09	4.31

Table 10.7 Relative errors by type of farming

Type of farming	Relative errors at relevant cells (%)	Relative errors at all cells (%)
General field cropping	9.34	9.74
Specialist horticulture (not greenhouse)	22.68	27.12
Specialist horticulture (greenhouse)	13.06	15.31
Specialist vineyards	2.45	6.91
Specialist fruits and citrus fruits	9.02	9.92
Specialist olives	6.12	6.48
Various permanent crops combined	8.68	10.41
Specialist dairying	2.21	5.61
Cattle - combined	2.30	11.80
Sheep and goats	2.39	3.14
Sheep, cattle and other grazing livestock	5.82	25.30
Pigs	9.50	9.56
Fowl	15.44	43.36
Specialist combined granivores	13.01	64.32
Mixed cropping	6.03	6.55
Mixed livestock	7.36	10.87
Mixed crops and livestock	2.94	3.01
Total	2.09	4.31

both for only relevant cells and for the entire population of commercial farms. Results are shown in tables 10.6, 10.7, and 10.8.

The precision of the estimate of national TGM is 2.09% for the relevant cells and 4.31% for all commercial farms. By region, Castilla Leon (3.17%) and Castilla-La Mancha (3.89%) present the lowest relative error for relevant cells, whilst Castilla-La Mancha (5.00%) and Baleares (5.30%) for all farms. Canarias shows the greatest relative errors in the two categories (22.10% and 24.20% respectively).

By farming type, the largest errors appear in *Horticulture (except greenhouse)* (22.68% and 27.12%), but it is worth pointing out that errors in *Fowl and various granivores* are very high especially for all cells due to the large number of farms which are considered irrelevant. This fact is related to the low level of importance of these farming types across regions.

Table 10.8 Relative errors by economic size units

Economic Size Units	Relative errors at relevant cells (%)	Relative errors at all cells (%)
[4,8)	1.31	4.05
[8,16)	1.18	3.48
[16,40)	1.33	3.40
[40,100)	1.41	3.48
[100,250)	1.74	3.86
[250, ∞)	14.68	17.13
Total	2.09	4.31

By size class, the errors are moderate except in the case of farms with more than 250 ESU (14.68%), which are obviously paying the price of restriction 2.

10.6 The 1999 RECAN sample: an evaluation

The purpose of this final section is to analyse how representative the actual 1999 RECAN sample is with respect to the 1999 Agricultural Census. To do this, we decompose the errors in national TGM estimation based on the 1999 RECAN sample into either errors due to difficulties in covering sampling quotas (cells without observations) or sampling error.

In order to do so, we must determine how much of the deviation in the TGM estimation carried out by RECAN is due to the lack of farms in some cells in the sample and how much is due to the sampling. We assume that the 1999 RECAN sample was obtained by stratified simple random sampling method without reposition. Therefore, a linear aggregate TGM estimator in Spain is equal to the total of the TGM (calculated from the 1999 RECAN data) in each defined cell times the inverse of the probability that the farm will be selected in the cell (i.e., the elevation factor).

The percentage deviation of the actual 1999 RECAN sample estimate of national TGM from the 1999 Agricultural Census estimate is not negligible: -20.01%. This relative error has its origins in two different sources. The first source is the fact that there are various cells for which there are observations in the 1999 RECAN sample but the elevation factor is undefined, causing a bias in the estimator and increasing the relative error of the estimation. The second source is that the design of the sample necessarily implies a theoretical sampling error, which is reflected in the estimated relative error.

It can be seen that, with the exception of *Olives*, there is an underestimation of the TGM in all categories considered, be they regions, size or type of farming. This is due, as we shall see below, to the lack of observations in numerous cells causing a downward slant in the estimation of national TGM. By Autonomous Region, the estimated TGM of The Balearic islands is 85.34% lower in the RECAN than the value assigned by the 1999 Census, while the estimation which comes closest to the value given in the Census is Andalusia (9.12% lower). By farming types, *Olives* are overestimated by 5.78%, and the rest is underestimated. By economic size, all estimations were below the real value, especially the estimation of TGM of farms of more than 250 ESU (-65.10%).

To quantify which part of the total relative error is due to the selection type which RECAN 1999 followed in choosing the farms, and which part is due to the existence of cells with no observations, we divide the population of surveyed farms into two subpopulations: (i) farms which pertain to cells with a number of farms sampled by the 1999 RECAN strictly greater than zero and, (ii) farms in cells without farms in the 1999 RECAN.

By studying the 1999 Agricultural Census, it is possible to compute national TGM that was beyond the scope of the 1999 RECAN population target and thus, given the stratification and the chosen estimators, the size of the error in the national TGM estimation using the actual 1999 RECAN sample. The percentage of national TGM in this situation is 20.38%. Therefore, if we estimate national TGM for the subpopulation of farms for which there are data in the 1999 RECAN without error, we would still continue underestimating the aggregate TGM for Spain by 20.38%. For the Autonomous Regions, the greatest percentage of TGM which is beyond the scope of the 1999 RECAN is in Baleares (98.83%), while that of Castilla Leon and Andalusia is only 10.26% and 11.66% respectively. By farming type, in *Mixed livestock* and *Fowl*, 61.25% and 60.67% of the TGM were beyond the 1999 RECAN scope, whereas in *Olives*, only 2.13% is left out. As far as the size classes, the 1999 RECAN tends to concentrate in Medium farms (between 8 and 40 ESU), while it leaves out considerable TGM mainly from large farms (more than 100 ESU), and to a lesser degree in small farms (between 4 and 8 ESU).

However, the percentage deviation error of the aggregate TGM for Spain for the farms with sample in the actual 1999 RECAN sample is much lower. At the maximum level of aggregation, the TGM estimator using data from the 1999 RECAN estimates the TGM with relative reliability (0.47%) if it has a sample in the cells. The relative errors for the subpopulation are low in absolute value for all regions. In Aragon, Castilla Leon, Valencia, Murcia and Extremadura the TGM is underestimated, which suggests that there is no bias in the estimator. In absolute value, the greatest relative errors show up in Baleares (31.22%), probably due to the low number of observations collected, Murcia (-18.27%) and Canarias (16.92%) surely due to the great variability in TGM in these regions. In relation to farming type, the greatest relative error is in *Horticulture (except greenhouse)*, which is underestimated with a 16.67%, and the lowest in *Various granivores combined* (-0.59%). By class size, types below 40 ESU have overestimation, whilst types above that level are underestimated with a tendency to a lesser relative error (in absolute value) as we move towards the centre of farm size distribution.

These total relative errors can be broken down into two parts: (i) the relative error due to the sampling method and, (ii) the relative error due to the non-existence of observations. Let r be the total relative error, r1, the relative error for the subpopulation in which the observations from the 1999 exist and **Error! Objects cannot be created from editing field codes.** the proportion of the TGM in the census for those which have information in the 1999 RECAN, then **Error! Objects cannot be created from editing field codes.**.

Table 10.9 Relative error by region. the descomposition by origin: Relative error due to the type of sampling and the relative error due to lost observations

Region	Relative error due to the type of sampling (%)	Relative error due to lost observations (%)
Galicia	2.72	-19.79
Asturias	1.63	-22.62
Cantabria	4.16	-20.13
País Vasco	5.35	-26.81
Navarra	2.10	-16.10
La Rioja	1.42	-34.30
Aragón	-3.85	-13.21
Cataluña	0.99	-16.85
Baleares	3.49	-88.83
Castilla-León	-0.18	-10.26
Madrid	2.75	-29.41
Castilla-La Mancha	0.19	-26.17
Comunidad Valenciana	-0.24	-23.17
Murcia	-9.58	-47.57
Extremadura	-0.90	-34.76
Andalucía	2.54	-11.66
Canarias	3.90	-76.96
Total	0.37	-20.38

The above Equation means that the total relative error can be broken down into two parts: (a) The relative error committed in the estimation of the TGM for cells with observations in the 1999 RECAN weighted by the percentage in the TGM that represents those cells (which we will call relative error due to sampling type) minus (b) the percentage of TGM of those cells where no observations exist in the 1999 RECAN (which we will call relative error due to lost observations). It is easy to see that when there are no observations, the relative error committed is always 100%. For this reason, the weight of the total relative error is equal to **Error! Objects cannot be created from editing field codes.**.

Tables 10.9, 10.10 and 10.11 show which part of the relative error is due to the selection method followed by the 1999 RECAN, and which is due to a lack of information.

Table 10.10 Relative error by type of farming. the descomposition by origin: Relative error due to the type of sampling and the relative error due to the empty cluster in the sample

Type of farming	Relative error due to the type of sampling (%)	Relative error due to lost observations (%)
Specialist cereals, oilseed and protein crops	1.77	-8.95
General field cropping	-0.76	-11.02
Specialist horticulture (not greenhouse)	-10.18	-38.97
Specialist horticulture (greenhouse)	-2.45	-29.17
Specialist vineyards	3.09	-33.67
Specialist fruits and citrus fruits	-1.03	-24.76
Specialist olives	7.90	-2.13
Various permanent crops combined	-0.62	-37.05
Specialist dairying	1.47	-13.73
Cattle - combined	2.01	-21.31
Sheep and goats	-2.25	-13.63
Sheep, cattle and other grazing livestock	1.00	-46.55
Pigs	-6.85	-25.88
Fowl	4.04	-60.67
Specialist combined granivores	-0.32	-45.22
Mixed cropping	0.74	-26.44
Mixed livestock	-1.17	-61.25
Mixed crops and livestock	-0.54	-20.07
Total	0.37	-20.38

Table 10.11 Relative error by size. the descomposition by origin: Relative error due to the type of sampling and the relative error due to the empty cluster in the sample

Economic size units	Relative error due to the type of sampling (%)	Relative error due to lost observations (%)
4-8	10.36	-13.87
8-16	6.21	-8.15
16-40	1.21	-5.23
40-100	-4.46	-10.40
100-250	-2.83	-39.40
>250	-2.90	-62.21
TOTAL	0.37	-20.38

In general, the relative error due to lost observations is much larger than the relative error due to sampling and of the opposite side.

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11. Measuring Representativity in Farm Accountancy Data Networks

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Abstract

Users expect results of Farm Accountancy Data Networks to be representative (for their purposes). Due to the fact that these networks only meet requirements made towards random samples in part or not at all, it is not known to which degreea sample result differs from the true value in the population. Furthermore, probability based methods that serve to measure precision cannot be applied or can only be applied with certain reservations. A project plan that aims at determining differences between sample results of the Swiss FADN and the values in the population is presented. The analysis is based on five methodologically different approaches.

11.1 Introduction

Farm Accountancy Data Networks (FADN) on regional, national or international level have to serve different purposes. Users in research, education, extension, agricultural valuation or in decision-making processes normally expect FADN-results to be representative.

However, what they mean by 'representative' usually remains unclear. Representativity is the opposite of a well-defined term. An analysis of its wide and very different use in non-scientific literature led Kruskal and Mosteller (1979, p. 23f) to the conclusion that the term should either be carefully defined or avoided.

In statistical literature, representativity is often not a characteristic of a sample but a description of the manner according to which the sample is obtained, e.g. 'representative sampling', 'probability sampling', or 'random sampling'. In a random sample, the probability for being included in the sample is known and above zero for each element of the (well-defined) population. If a sample meets that requirement, the whole apparatus of probability-based estimation can be applied, including the estimation of the precision of any result.

FADN samples are far from being perfect random samples. Possible reasons may be:

- if randomly selected, the response rate is below 50%;
- if random selection was carried out several years ago, panel mortality and replacement of farms do not comply with random principles;
- if farms are randomly determined within the scope of a sample plan, the last step for the selection is influenced by practical circumstances (e.g. workflow in an accounting office);
- the inclusion of a sample farm in the sample of a specific year depends on completeness and plausibility of the data collected and the timing of data delivery;

- quota sampling is chosen instead of random sampling;
- samples are based on 'available' farms; therefore, no specific sampling procedure is applied.

The problem that arises from these inconveniences has two aspects:

- it is not known, to which degree a sample result differs from the true value in the population;
- probability-based methods that serve to measure precision cannot be applied or can only be applied with certain reservations.

11.2 Methods for measuring representativity in the Swiss FADN - A project description

The Swiss FADN is based on a stratified selection plan comprising incentives for under-represented farms and penalties for over-represented farms. The selection is made by the accounting offices. Consequently, the sample is not a random sample but it has certain main properties of a quota sample.

In an ongoing project, we try to determine the differences between the sample results of the Swiss FADN and the values in the population. The analysis is based on five methodologically different approaches.

1. Comparison of *structural variables* from raised sample results (using farm weights) with known results on sectoral level (e.g. land use and livestock numbers according to the annual structural survey).

   Comment: As the main structural variables are used in the weighting procedure, special care must be taken when distinguishing between the effects of the biased sample and the effects of the (imperfect) weighting system.
2. Comparison of *financial variables* from raised sample results (using the farm-weights) with 'known' results on *sectoral level* (e.g. expenditures for fertilisers or investments in machinery; data derived from national accounts for agriculture or statistics available from relevant companies or associations).

   Comment: The financial results on sectoral/national level are often estimates themselves, and sometimes even based on FADN-results. The population of the FADN normally does not include the whole agricultural sector. Statistics published by commercial institutions often include non-agricultural and/or household consumption.
3. Comparison of *financial variables* from sample farms with *other samples or registers* (e.g. expenditures for compulsory insurance or income in tax registers).

   Comment: These analysis can be extended from comparisons of means or sums to differences in distributions. However, problems with the definition of the variables from different sources and restrictions by data protection regulations must be taken into account.
4. Analysis of the *relation between structural and financial variables*

   Comment: A high correlation means that a high degree of correspondance of the structural variables leads to reliable results with regard to financial variables. Any correlation on sample farms may be different from those observed on non-sampled farms. Often the degree of correlation is fairly low. Can we 'construct representativity' by adapting the weighting system? Can more than one stratification scheme be implemented in a weighting procedure?

5. Analysis of *selective forces* relevant for the constitution of the sample. Factors determining whether a farm is included in the sample are: requirements made towards the accounting system; degree of voluntary or compulsory participation; decision-making processes at accounting offices; time limits for delivery, exclusion by plausibility tests.

   Comment: As these selective forces are also relevant for dealing with non-response in random samples, the corresponding literature is a good source.

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12. The Safety Net for Farmers in Comparison with the General Population: Experiences from the U.S. and the Netherlands

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12.1 Introduction

Agricultural policies have several objectives. One of them, and in the eyes of the public not the least important one, is to provide a safety net for farmers. According to the Treaty of the EU (article 39) one of the objectives of the Common Agricultural Policy is to ensure a fair standard of living for the agricultural community by increasing individual earnings. In the U.S., historically, the justification for a farm safety net had to do with the high poverty rates of farmers and their large numbers of farmers in the population. Despite the absence of these two justifications today, farm safety net policies continue in the U.S.

In addition to these profession-specific safety net programs, farmers are also entitled to use the safety nets for the general population. This is nothing new, but it raises a number of interesting questions, especially against the background of some recent trends. First, the number of farmers in industrialized countries with off-farm income has risen. In the U.S., the number of farm households with off-farm income increased by more than 15% in the post-World War II era (Gould and Saupe, 1989). As outside income becomes a larger part of farm household income and farmers are incorporated into the non-farm sector in other ways, it raises questions about the continuing need for a special agricultural safety net.

Second, the number of farmers has been declining by a few percentage points per year and so today only a small portion of the population works in agriculture. As the percentage of farmers in the population becomes smaller, the social welfare improvements due to the farm safety net are correspondingly smaller.

Third, agricultural policies change. After World War II, increased food production via rising productivity and price supports was an important objective of agricultural policy. At the end of last century this has given way to conservation policies (multi-functionality in Europe) and direct income support. The original justification for the maintenance of food security is no longer valid insofar as food insecurity is not a function of domestic output in ones own country; international agricultural trade is pervasive enough that any shortfall in production is easily remedied.

As the provision of the agricultural safety net changes in the US and the EU, in this paper we consider issues regarding the replacement of the agricultural safety net with the general safety net. To investigate this we have chosen to examine the Netherlands and the

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United States. We chose these two countries because while there are of course differences (e.g., farm sizes are larger in the U.S.; agricultural employment as a percentage of total employment is higher in the Netherlands (OECD, 1994)), the similarities between these two developed countries, in both the agricultural and non-agricultural sectors, allow us to control for the differences in safety net policies. In particular, this similarity allows us to help understand the impact of two sources of variation between the countries as it applies to the well-being of farmers. First, in the Netherlands, three-quarters of total farm household income in the Netherlands is from agricultural sources while only 15% in the U.S. is from agricultural sources. We therefore may expect changes in farm subsidies to have different implications for the two countries. Second, the social safety net in terms of both cash and non-cash benefits is more extensive in the Netherlands than in the U.S. (Smeeding et al., 1993, table 12.1). This has lead to substantially lower poverty levels (Achdut and Kristal, 1995, table 12.1) and lower inequality (Buhmann, 1988, table 12.5) in the Netherlands than in the U.S. This difference in the scope of the general safety nets may lead to differential abilities of farmers in the two countries to access the broader safety net. Third, the character of agriculture is different: the Netherlands is more involved in horticulture, and agriculture is located closer to the big cities where non-agricultural employment is available. On the other hand the U.S. has a more flexible labour market. Recently both countries enjoyed a booming economy and high employment.

Table 12.1 Distribution of farm program payments by farm typology, 1997

	Limited resource	Retirement	Residential lifestyle	Farming, low sales	Farming, high sales	Large family	Very large family	Agri-business	Total
Average direct government payment ($)	424	1,906	941	2,307	7,987	13,483	19,411	5,975	2,903
Payment per recipient ($)	2,183	6,395	3,844	4,948	10,889	17,766	32,087	16,401	7,987
In % of total income	25.3				21.4	22.8			
Farms receiving payments (%)	19.4	29.8	24.5	46.6	73.4	75.9	60.5	36.4	36.4
AMTA (%)	11.9	17.5	17.1	40.7	69.1	72.3	55.9	22.8	28.8
CRP and WRP (%)	5.4	17.3	9.3	9.1	13.0	10.7	10.4	18.7	10.6

Notes: AMTA denotes Agricultural Market Transition Act, CRP denotes Conservation Reserve Program, and WRP denotes Wetlands Reserve Program. This table is from table 9 of Gundersen et al., 2000.

Our paper begins with a review of two broad areas of previous research - definitions and justifications for the social safety net and the consistency of the current farm safety nets with respect to these definitions and justifications. We then update the existing research as it regards the efficacy of the farm safety net. While the farm safety net is one method of ensuring the well-being of farmers, in both countries there is a wide variety of other assistance programs available to both farmers and the general population. We review these safety net programs and then consider both the eligibility and the participation of farmers viz. the general population in these programs. The extent of current eligibility and subsequent participation in these programs is of interest but also of interest is the following question: In the absence of the farm safety net, what might be the eligibility and participation of farmers in the safety net? We finish with some concluding remarks, emphasizing the policy conclusions and directions for future research.

12.2 Literature Review

Safety Net

There are several well-known arguments for the provision of a safety net. One class of arguments is based on peoples' preference for the reduction of income uncertainty and income variability. For example, people may favor a safety net as a form of social insurance against future income volatility (Buchanan and Tullock, 1962). As Haveman (1985) claims, '(T)he primary economic gain from the welfare state is the universal reduction in uncertainty faced by individuals.'

Another class of arguments invoke altruism. Thurow (1971) argues that if peoples' utility (or level of satisfaction) depends on other peoples' consumption as well as their own, they will favor policies which provide everyone a minimum standard of living. Thurow also asserts that if people are concerned about the way that income is distributed, they will receive satisfaction from the redistributive effect of safety net programs.

A third class of arguments for the provision of a minimum standard of living stems from social welfare considerations. The approaches in this class of arguments utilize the concept of a Social Welfare Function (SWF), which is obtained by aggregating over the utilities of everyone in a nation, society, or subgroup (for example, farmers). The utility of any person with respect to income is denoted by U(y) and the SWF by:

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where f(y) is the frequency distribution of income. Suppose this SWF is additively separable (i.e., a person's utility is independent of others' utilities) and symmetric with respect to income (i.e., no person's utility is judged to be more important than another's). In terms of individual utility functions, suppose that U(y) is strictly concave (i.e., the marginal utility of an additional unit of income is positive but decreasing). Under these assumptions, any transfer of wealth from a richer person to a poorer person improves the social welfare of a country (see, e.g., Atkinson, 1970; Dalton, 1920; Dasgupta, Sen, and Starret, 1973; and Rothschild and Stiglitz, 1973). A social safety net that makes this transfer will therefore improve societal welfare, as defined by this general SWF.

Within this social welfare framework, economic theorists such as Harsanyi (1953, 1955), Vickrey (1960), and Rawls (1971) explored other conditions under which a society would be better off with a social safety net. They found that, if its members are uncertain as to their income potential and are averse to risk, society is better off with a social safety net. These arguments relate closely to the concept of safety nets, discussed above, as a form of social insurance.

The above formulations do not necessarily incorporate any notions of poverty. In practice, however, definitions of poverty are often utilized to ensure an effective distribution of safety net benefits to those most in need. As long as the poverty line is set below the median income level, any distribution of benefits to those below the poverty line will be welfare improving in the sense outlined above.

When choosing a poverty line, the researcher must decide whether to use an absolute or a relative poverty line. An absolute poverty line is set without reference to the distribution of incomes within a society. For example, in the U.S., the poverty line was originally set as a multiple of a minimally acceptable basket of food (Orshansky, 1965). Since then, the poverty line has been updated annually to take into account inflation. In distinction to an absolute poverty line, a relative poverty line is defined with respect to the income distribution.[1] As an example, a poverty line may be set as 25% of the median income level. With this type of poverty line and the absolute poverty line, in theory, poverty can be eliminated. Another type of relative poverty line, however, does not have this property. Here the relative poverty line is set such that, say, households in the bottom 25th percentile of income are defined as poor.

The Farm Safety Net in the United States

From its birth, the U.S. government has had a pronounced involvement in agriculture (Wanlass, 1920).[2] During the twentieth century, this involvement took on many forms. In some instances, there were public good aspects to agricultural policy. As an example, the rural infrastructure (e.g. irrigation, drainage, postal service) was enhanced via the involvement of the USDA. In most instances, however, agricultural policy was aimed at providing benefits to farmers themselves. If these benefits were evenly distributed to farmers and if farmers were poorer, on average, then the general population such a distribution could be seen as welfare improving. And this used to be the case; farmers were far poorer than the rest of the population. In the 1940's, per capita income of farmers was, on average, 50.7% that of non-farmers (Gardner, 1992; table 12.1). Moreover, given that most people lived on farms in the first half of the 20th century, efforts to alleviate poverty among farmers likewise eased the burden of poverty for a large segment of the population. The design of farm programs provided support over two broad areas of commodity production. In the 1930s, U.S. farms were not so specialized in production as today, so most farmers grew one or more supported commodities (wheat, feed grains, dairy, cotton, sugar). As a consequence, benefits were broadly distributed across farm households.

By the 1980s though, the average farmer was as well-off or even better-off than the general population. Then, even if benefits continued to be evenly distributed, it is difficult to argue that such benefits were part of the social safety net. Today, however, benefits are concentrated on larger farms because the volume of production remains the main criterion for benefit distribution. As a consequence, benefits do not accrue to low-income farmers. Instead, government payments tend to go to farmers higher in the income distribution.

In table 12.1 we present the distribution of farm payments broken down by farm typology. This farm typology distinguishes farms and farm households based on sales

[1] This type of poverty line is often used for cross-country comparisons where absolute poverty lines are not transferable. See, e.g., Smeeding et al., 1993; Casper, McLanahan, and Garfinkel, 1994; and Achdut and Kristal, 1995.

[2] This section, and references therein, rely heavily on Gardner, 2002.

volume, occupational choice, and in some cases, level of assets. This typology identifies eight categories, five of which distinguish among farms with gross sales below $250,000 (the Small Farm Commission's definition of 'small farms' (Hoppe, Perry, and Banker, 1999)). Residential lifestyle farms, the largest group with more than 800,000 households, are small farms where the operator's primary occupation is something other than farming. The category defined as farming, low sales (around 400,000 households) are farms with sales of $100,000 or less where farming is the primary occupation of the operator. Large family farms have annual gross sales between $250,000 and $500,000. Very large family farms have gross sales of more than $500,000. The latter two typology groups accounted for more than 40% of the total value of agricultural production in 1997.

Of particular interest for this paper are the limited resource farmers, the group of farmers most likely to need the safety nets available to the general population. These farms are defined as any farm with: (1) gross sales less than $100,000, (2) total farm assets less $150,000, and (3) total operator household income less than $20,000. Limited resource farmers may report farming, a nonfarm occupation, or retirement as their major occupation.

As seen in table 12.1, 19.4% of the limited resource farmers received government support payments. In contrast, 73.4% of farming, high sales farms and 75.9% of large family farms received government support payments. These are two of the wealthiest categories of farms. Not only do a higher percentage of farm support payments go to wealthier farmers, the size of these payments are also substantially higher. For limited resource farmers receiving payments, the average payment is $2,183 while the average payments for farming, high sales and large family farms are $10,889 and $17,766.

So, both in coverage and magnitude, wealthier farmers fare better than poor farmers. One aspect of the farm safety net, however, is consistent with the usual definition of a safety net. Government payments for receiving limited resource farmers constitute 25.3% of their total income while the comparable percentages for farming, high sales and large family farms are 21.4 and 22.3%. While this difference is not large, as a percentage of their total household income, poorer farmers receiving benefits tend to do slightly better than well-off farmers.

The Farm Safety Net in the Netherlands

The Dutch government became involved in agriculture during the farm crises of the second half of the 19th century. Later, the involvement concentrated on infrastructure and what we now call knowledge management but it was not until the 1930s that price and income supports were introduced. After World War II a national support policy was based mainly on deficiency payments. It became expensive and the policy was replaced by the EU's Common Agriculture Policy (CAP). In the fifties and early sixties agriculture was not able to release labor quick enough to raise productivity and income. During this time, incomes were low, especially on the poor sandy soils in the eastern part of the country (in those days, an area relatively inaccessible from the richer west and only in the last century transformed from subsistence farming to market integration). Farm workers and small farmers (or at least their sons) left in droves to join the labor market in the cities in the west (and some to the U.S., Canada and other emigrant destinations). In the sixties these migration flows became smaller: farm workers had left and farm families were too small and too little to sustain migration.

Until the 1990s the CAP was mainly based on a price support in a net-importing region. In the early 1990s the CAP was reformed via the introduction of direct payments, as compensation for lower prices due to the EU becoming a net-exporter instead of a net-importer. These changes, however, had little impact on the Netherlands, because of its concentration in sectors less influenced by CAP: horticulture, potatoes and pigs and poultry. Two other items produced by the Netherlands, sugar and milk have a quota system and (until now) no direct payments.

In the EU there are less than 2000 holdings receiving more than €300,000 in 2000 (European Commission, 2001). At most, a handful of them are located in the Netherlands. In the EU 50% of the payments go to 5% of the holdings that claim and received a payment. In the Netherlands this distribution is also skewed, but less then in the EU as a whole: about 50% of the payments go to 12% of the holdings. Fifty percent of the farmers receive less than €1,625, 15% of the budget.

Table 12.2 Results (in € per farm) for farmers in the Netherlands classified to poor and non-poor on the basis of their total (farm and off-farm) income: 1995 to 1997

	Poor households	Non-poor households		All households
		poor, based on farm income	non-poor based on farm income	
Share of households (%)	23	21	56	100
Share of farms (%)	23	22	55	100
Farms size (DSU)	74	45	119	94
Profit and loss account:				
Total output (€)	115,250	86,055	240,315	178,800
EU direct payments (€)	1,470	2,000	1,475	1,585
Family farm income (€)	2,430	9,915	51,420	31,385
Income Statement				
Non-farm income (€)	5,225	16,565	6,020	8,105
Total family income (€)	7,655	26,480	57,440	39,490
Taxes paid (€)	670	3,935	9,350	6,215
Household consumption (€)	19,455	23,740	28,730	25,550
Savings (€)	-10,590	-270	20,510	8,990
Cash flow (€)	8,300	11,300	51,800	33,200

Notes: DSU denotes Dutch Size Units, roughly equivalent to European Size Units (ESU). Data is from the Dutch FADN.

In table 12.2, we consider the poverty distribution amongst farmers and the distribution of farm safety net payments in the Netherlands for the years 1995-1997. The average farm household in the Netherlands earns €39,4990, of which € 31,385 is from farm income and €8,105 is from non-farm income (this and all the following information is from Poppe, 2002, and Everdingen et al, 1999).[1] The average EU direct payment to farmers is € 1,585.

Turning to a consideration of income distribution, 23% of farm households are below the poverty line [2] and the average farm income amongst them is €2,430. In poor households, direct payments constitute 60.4% of total farm income whereas in non-poor households earning more from off-farm than on-farm employment the figure is 20.1% and in non-poor households earning more from on-farm than on-farm employment, the figure is 2.8%. This lower percentage is not due to a lower amount of direct subsidies, but due to higher income. A non-trivial number of payments are received by relatively well-off farmers.

When the sample is confined to family farm income only (excluding non-farm income), the CAP support is highest for the group with the smallest income. From this perspective the policy is in line with the safety net concept, and seems to contribute to social welfare for the theoretical reasons noted previously. However, if one takes into account that farm families are now more integrated in labor markets and one looks to total family income, the distribution is more skewed. And the targeting of direct payments from a point of view of the social safety net is less perfect. It is also important to note is that the effect of a progressive income tax system in the Netherlands has a bigger effect than the EU direct payments (for which many are not eligible unless they change their farm structure).

12.3 Eligibility and Participation of Farmers in Non-Agriculture Safety Net Programs

In the United States

The farm safety net in the U.S., in practice if not in design, primarily benefits more well-off farmers.[3] Even though farm program payments are largely bypassing lower income farmers, it is possible that these farmers are benefiting from safety net programs designed for the population as a whole. We now consider whether this is the case with respect to one of the largest assistance programs in the U.S., the Food Stamp Program.

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[1] The data reported here are based on data of all Dutch farms above a certain threshold (representing 94% of production). This includes farms not eligible for CAP support, but that does not undermine our analysis. Policy makers that want to increase social welfare by handing out direct payments from tax money can decide to include or exclude a certain product or sector.

[2] This poverty line was calculated in a research project (Everdingen et al., 1999). It was based on social security regulations, with corrections for self-employed who face extra costs, e.g. for insurance. The calculated poverty line is not used as a safety net in official regulations.

[3] As we discuss above, to call these programs a 'safety net' is perhaps a misnomer. There are, numerous other justifications one could potentially use to justify these programs. But as income support is an important justification and as we are interested in this issue of the policies, we stick to this nomenclature.

We have chosen to examine the Food Stamp Program because it is available to virtually the entire low-income population (other assistance programs like TANF are only for segments of this population); it can constitute a substantial portion of families' income (in some Southern states, food stamps, if valued as cash, make up more than 50% of some families' income); and benefit levels are inversely related to income rather than in a lump-sum format.

The Food Stamp Program served approximately 17.2 million individuals in 2000 with an annual benefit distribution of $15 billion, or approximately $73 in monthly benefits per person.[1] Between 1988 and 2000, 47% of all food stamp recipients were children, and in 2000 approximately 57% of food stamp households include children. The modern version of food stamps began as a pilot project in 1961 and became a nationwide program in 1974.

This cornerstone of food assistance programs works under the principle that everyone has a right to food for themselves and their families and, hence, with a few exceptions, this program is available to all citizens who meet income and asset tests. Participants receive benefits for the purchase of food in authorized, privately run retail food outlets selling food to participants and non-participants. While authorized stores may also sell nonfood products, food stamps cannot be used to purchase nonfood items such as soap, toiletries, household paper products, prepared foods, or medicines. For almost all food stamp recipients, benefits are distributed via an Electronic Benefit Transfer (EBT) card. The EBT card is operationally similar to an ATM card.

To receive food stamps, households must meet three financial criteria: the gross-income test, the net-income test, and the asset test. A household's gross income before taxes in the previous month must be at or below 130% of the poverty line ($1,533 per month in fiscal year 2000 for a three-person household, the most common food stamp household). Households headed by someone over the age of 60 are exempt from this test, though they still face the other tests. In addition to the gross-income test, a household must have a net monthly income at or below the poverty line.[2] Finally, income-eligible households with assets less than $2,000 qualify for the program ($3,000 for households headed by someone over age 60). The value of a vehicle above $4,650 is considered an asset unless it is used for work or for the transportation of disabled persons. The value of a home is not considered an asset. Households that receive the Temporary Assistance for Needy Families (TANF), or households in which all members receive SSI, are categorically eligible for food stamps and do not have to meet these three tests.

In table 12.3 we examine the participation of farm households in the Food Stamp Program. We do so for every year from 1991 to 2001. To garner a sense of these participation rates, we compare these with the participation rates for the population as a whole. To

[1] Total federal expenditures on the Food Stamp Program, including the federal share of state administrative expenses, amounts to $18.9 billion in 2001, which is almost 60 percent of the total expenditure on all domestic food and nutrition assistance programs. The next two largest food assistance programs are the National School Lunch and Breakfast Programs, ($9.3 billion) and Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) ($4.0 billion).

[2] Net income is calculated by subtracting a standard deduction from a households' gross income. In addition to this standard deduction, households with earnings from the labor market deduct 20% of these earnings from their gross income. Deductions are also taken for child care and/or care for disabled dependents, medical expenses, and excessive shelter expenses.

ensure the appropriate comparisons, we consider these rates within the same data set, the Current Population Survey (CPS).

Table 12.3 A Comparison of Participation and Eligibility Rates for the Food Stamp Program Amongst U.S. Farm Households and the General Population

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Participation Rates (percent)											
Entire Population	7.66	8.05	8.53	8.47	7.77	7.54	6.57	5.65	5.21	4.94	5.46
All Farm Households	1.56	0.92	1.63	2.41	2.09	1.73	1.62	1.46	1.35	1.42	1.75
Eligibility Rates (percent)											
Entire Population (Gross Income Test)	19.12	19.17	19.84	19.73	18.88	18.74	17.94	17.16	16.39	16.25	16.43
All Farm Households (Gross Income Test)	14.17	15.74	16.48	12.72	10.83	11.17	10.73	12.72	13.70	9.54	10.64
Entire Population (Gross Income and Asset Tests)	16.14	16.26	16.75	16.95	16.16	16.45	15.72	14.99	14.17	14.11	14.49
All Farm Households (Gross Income and Asset Tests)	7.91	8.38	9.49	7.73	6.75	6.35	7.37	9.34	9.75	6.49	7.41

Notes: Data is from the respective years of the Current Population Survey (CPS).

The CPS is administered monthly by the Census Bureau for the Bureau of Labor Statistics to approximately 50,000 households. It is the primary source of information on the U.S. labor force. The survey collects data from a nationally representative sample of households on a wide variety of questions. In this paper we rely on four primary groups of questions - on food stamp participation; on income; on returns from assets; and on source of earnings. We define a farm household as one where (a) the family gets at least a portion of their income from a farm and (b) at least one person in the family lists farm self-employment as their main job.

As seen in table 12.3, in every year participation rates for farm households are substantially lower than for the entire population. For farm households, participation rates vary from 0.92 to 2.09. For the entire population, the participation rates range from 4.94 to 8.47%. In addition, perhaps due to the small number of farm households utilizing the Food Stamp Program, the sharp drop in the number of food stamp recipients from 1994 to 2001 is not evidenced amongst farm households (for more on the reasons for this decline, see Ziliak, Gundersen, and Figlio, 2003).

Even if farm households are eligible for food stamps, just as in the general population many will choose not to participate. This decision not to participate is often ascribed to three main factors. First, there may be stigma associated with participation. Stigma encompasses a wide variety of sources, from a person's own distaste for receiving food stamps to his or her desire to avoid disapproval from others when redeeming food stamps to the possible negative reaction of caseworkers (Moffitt, 1983; Ranney and Kushman, 1987). Second, transaction costs increase the pecuniary and non-pecuniary disadvantages to participation. These transactions costs include the amount of time to get to the food stamp office and the time spent in those offices; the burden of taking children to the office or paying for child care services; and the availability and costs of transportation. To remain a participant, a household faces these costs on a repeated basis when it must recertify its eligibility. Other costs that a household faces only when applying for the program include the time and effort needed to acquire all the necessary paperwork and to fill out the application forms. Third, the benefit level may be too small to induce participation. Food stamp benefits can be as low as $10 a month for a family. At higher benefit levels, the benefits to receiving food stamps may outweigh the costs but this may not hold at lower levels. One further possible reason for non-participation and more common to farmers, is a family's ability to utilize their farm as a personal food source. If this food source is sufficiently large, the need for food stamps is correspondingly diminished. In comparison with higher-income farmers, lower-income farmers are less prone to produce food for a far-away market with little in common with their own food preferences. While farmers only constitute a small fraction of rural households, take-up rates in rural areas in recent years has been higher than in urban areas. In 1998 the food stamp take-up rate was 63% in urban areas and 73% and 73%in rural areas (McConnell and Ohls, 2001).

In table 12.3 we therefore consider the percentage of eligible households amongst farm households and amongst the entire population. We split this into two categories - gross income eligible households and gross income and asset eligible households.[1] We do not directly observe asset levels in the CPS. We do, however, observe the amount of dividend and interest income received by households in the past year. We assume a 5% return to these assets and therefore multiply the dividend plus interest income by 20. Three assets which may be particularly relevant for farmers - the value of farmland, the value of a house, and the value of assets used for one's job - are not considered 'assets' for the food stamp asset test; it can be further assumed that the return from these assets do not come in the form of dividend or interest payments. In every year, the number of eligible households is larger in the general population than amongst farm households. This is true whether we consider the gross income test or both the gross income and the asset tests. While this may partly explain the lower participation rates of farmers, the main reason for the lower participation rates is the substantially lower take-up rate of farmers (i.e., the percentage of eligible households receiving food stamps). In every year, the take-up rate for gross income and asset eligible households in the general population is roughly 50%. For farmers, however, the highest take up rate is approximately 30%.

There is one further difference between farmers and the general population. When one moves from the gross income test alone to both the gross income and asset tests, the percentage point drop in the number of eligible farm households ranges from 3.0 to 7.4. In contrast, the percentage point drop for the population as a whole is 1.9 to 3.0. This demonstrates that the asset test appears to be a more binding constraint for farmers than for the general population.

[1] We do not include the net income test. However, virtually all families meeting the gross income test also meet the net income test. The main reason one would be interested in the net income test is to ascertain the expected benefit level for households. At this juncture, we do not consider this issue.

In the Netherlands

The safety net program in the Netherlands is de Bijstand ('The Assistance') and is run at the local level based on national guidelines. Self-employed persons access a system within this broader system, Besluit Bijstandsvoorziening Zelfstandigen ('The Assistance for Self-employed'). We will describe this system in more detail below.

In addition to de Bijstand, the social welfare system has other instruments including the progressive income tax. Also important is the pension system, in which every person over age 65 automatically receives a small state pension (AOW) that in most cases is above the threshold to be eligible for the Bijstand. As many farmers are older than 65 (and could opt for retirement if they wish) this is a cash flow to farmers not to be neglected. As the receipt of the pension is almost automatically based on the age of the person in the community's persons register, rather than an income-based criterion, we do not analyze this in detail here. A third instrument in the social welfare system for self employed persons is the income support for older and partly disabled ex-self employed (IOAZ). As this system is only open to persons with a specific handicap we will not discuss this in detail here because few farmers are eligible.

The Besluit Bijstandsvoorziening Zelfstandigen provides cash income support for all self-employed persons including farmers. If the income level is below the general safety net as defined in the program (and can be proven by accounts at the moment of the claim or soon afterwards), the self employed can receive a loan from the local government for 12 months, with a possibility for an extra 24 months. This loan bridges the gap between actual income and the safety net level. No interest on the loan is requested and remission is possible.

In addition, support can be granted to provide new capital to the business. If the business is viable but the banks are not willing to lend, the local government may act as a surety on a commercial loan. The local government can also provide an interest bearing loan of at maximum €152,000 which has to be paid back in 10 years. The interest is a market rate, but there are possibilities for forgiveness of the interest or part of the loan. In these cases the business has to be viable meaning that it provides an income and more than 1,225 hours of work. In case the own capital (net worth) is less than €36,000, all support, in certain cases, can be remitted. With a net worth of more than €146.000, no remission is possible. Within this range there is room for decision making by the local government, depending on the circumstances of the case.

Self employed persons older than 55 years with a non-viable business, can also get support. If their income from the business is at least €6,035, they can receive a supplement to bridge the gap with the safety net, until they reach age 65.

The number of farmers that make use of the Besluit Bijstandsvoorziening Zelfstandigen differs from year to year and depends on the business cycle. In 1997, 474 farmers participated in 1998, 552 and in 1999, 633. These years coincide with a large break out of Classical Swine Fever and subsequent years with low pig prices. In 2000 the number declined to 287, to go up again to 377 in 2001 (Silvis and Van Bruchem, 2002). With less then 100,000 farm holdings in the Netherlands, these numbers are between 0.2 and 0.6% of the total number of farms. As in the U.S., farm households have a smaller participation rate in the general safety net: in 1999 267,000 households participated in the Assistance program, 4% of the total number of households (data from Statistics Netherlands).

There has been no research regarding the number of farmers who are eligible for the Besluit Bijstandsvoorziening Zelfstandigen, nor has there been any on the difficulties farmers may face in enrolling. Information regarding the program is readily available since nearly all Dutch farmers use a commercial (tax) accountant and a (co-operative) bank which indicate whether a farmer is eligibile. In many agricultural sectors, price and business cycles have an important impact on incomes. Farmers are therefore used to saving in booming times for lean periods and can call upon their bank if they have income or assets but no liquidity. Against that background it is not logical to call upon the program in years with low income. The income tax system supports this by smoothing incomes over three years if necessary and additional carry back and carry forward options for losses. Moreover, most farmers have no reason to access these programs insofar as they have enough assets as security for new loans. This is especially the case in arable and dairy farming. It is not by chance that intensive livestock farmers (nearly a land-less industry in the Netherlands without many assets) and horticultural holdings make most use of the Assistance program.

The Bijstand program is seen as a very last option in the Netherlands, to be called upon after all entrepreneurial options in the commercial sector have been explored without results. Table 12.2 above shows that many farmers have a lot of commercial options. Even the group who has an income below the poverty-line[1] on average has a cash flow from depreciation and (at least some of them) can convince banks or relatives to provide new loans for investments. It is also clear that there is a large group of farmers using non-farm income to raise their income above the poverty line. In many of these cases farmers would not think about taking part in the Assistance program, and/or they may not even be eligible despite low farm income. The impression is that the participation is mostly due to unexpected or unexpectedly severe price-fluctuations in commodity markets like pigs, vegetables or energy (glass house horticulture).

12.4 Substitution of Agricultural Policy by General Safety Net Policies

As seen above, farmers are supported by a sector specific safety net and by a safety net for the entire population. Both the participation and take-up rates are substantially lower for farm households than for the entire population. We now consider whether this might change if the farm safety net were eliminated.

The Farm Safety Net in the United States

Because it has data about food stamp participation and to ensure comparability with the non-farm population, we used the CPS for the above analysis. We are now interested in the importance of farm safety net payments in the incomes of farmers and the possible conse-

[1] The poverty line used in the research for that table is higher than the safety net used in the Assistance program.

quences of eliminating these payments. The CPS does not have information on the value of farm safety net payments so we instead impute information about government payments from analyses using the Agricultural Resource Management Study (ARMS).

The ARMS is conducted annually by the Economic Research Service (ERS) and the National Agricultural Statistics Service (NASS) in all States except Alaska and Hawaii. The survey was formerly named the Farm Costs and Returns Survey (FCRS). Approximately 15,000 farms and ranches (defined as establishments from which $1,000 or more of agricultural products were sold or would normally be sold during the year) were contacted and their operators were personally interviewed. The ARMS is a probability-based survey in which each respondent represents a number of farms of similar size and type. Thus, sample data can be expanded using appropriate weights to represent all farms in the contiguous United States.

From analyses performed using the ARMS, we now turn to an ascertainment of the effect of losing farm government payments on the food stamp eligibility of farm households (Mishra et al., 2002; McElroy, 2002 - HaM). These analyses confine themselves to the years 2000 and 2001 and we do as well.

We calculate the effect of losing farm government payments in the following manner. In HaM, the average government payments to farmers are divided into four categories: farmers with incomes and assets higher than the median non-farm household (high income/high assets), high income/low assets, low income/high assets, and low income/low assets. The first two categories would not be eligible for food stamps, even if they lost large amounts of farm government payments so we disregard them in the following analysis. The other two categories are, however, potentially eligible for food stamps. To calculate the effect of losing farm payments we must therefore place farmers in the CPS into these four categories.

From the CPS we first identify farm households with low income/low assets and low income/high assets. The CPS does not have sufficient information to accurately portray the asset situation portrayed in the ARMS. In response, we therefore define assets in the manner described above; this then only includes more liquid assets. While this is a different definition of assets than in the ARMS, we believe there is a high correlation between liquid and other assets for farmers. However, in comparison to the breakdown found in the relevant tables in HaM (table 12.1 and table 12.3) there are more farmers in the low income/low assets category within the CPS and fewer farmers in the low income/high assets category. So, to be consistent with HaM we assign the lowest x percent within the income category in the CPS to the low income/low asset category where x is the percentage of farmers in this category in HaM. The remaining farmers in the low income/low assets category in the CPS and in the low income/high assets category in the CPS are assigned to the low income/high asset category.

Given these assigned breakdowns from the CPS (where the italics indicate these are the final breakdowns), we subtract the average government farm support payment from farm households' income where the farm support payments are those calculated in HaM. For the sake of simplicity, we presume a loss of these payments would entail no loss of assets.[1] We also presume that the farmers decisions would be the same, even in the absence of farm support programs.[2] In response to these changes, we then calculate the new food stamp eligibility rates for farm households. These are found in table 12.4 where we also repeat the relevant information from table 12.3.

Under the assumptions described above, in 2000, a loss of farm support payments would lead to a 4.0 percentage point increase in the number of farm households eligible for food stamps (3.7 percentage points if only the gross income test were used) and in 2001, there would be a 3.2 percentage point increase (3.1 percentage points). There are about 2 million farm households in the U.S. As a consequence, loss of farm support payments would lead to about 75,000 more farm households being eligible for food stamps. While this increase is non-trivial, the eligibility rates for farmers would still be below those for the population as a whole. Under the assumption that there is no change in the take-up rates amongst farmers, the increase in the number of farm households receiving food stamps would be trivial.

Table 12.4 Eligibility Rates for Food Stamps for Farm Households with and without Farm Safety Net Payments

	2000	2001
	With Farm Safety Net Payments	
Passing Gross Income Test	9.54	10.64
Passing Gross Income and Asset Tests	6.49	7.41
	Without Farm Safety Net Payments	
Passing Gross Income Test	13.21	13.73
Passing Gross Income and Asset Tests	10.55	10.69

The Farm Safety Net in the Netherlands

In the Netherlands, the number of farmers is very low. As a consequence, they can not be identified in the statistics of Statistics Netherlands and, as such, their participation in the de Bijstand. The best source for analysis is the Farm Accountancy Data Network (FADN), the European equivalent of ARMS. The data in table 12.2 are taken from that sample. Due to differences in income concepts between this FADN and the system of tax accounting it is not possible to calculate exactly how many farmers would be eligible for various assistance programs in the absence of farm safety net programs.

[1] In reality, this is unlikely to be the case insofar as farm support payments are an important factor in the calculation of land values. As land values decrease, this may also lead to a decline in liquid assets. The extent of such a decline is difficult to predict so we presume there is no change.

[2] There are distortions due to these programs which may make farmers' decisions very different in their absence. The possible extent of this distortion is not clear.

Table 12.5 Farmers in the Netherlands classified to poor and non-poor on the basis of their total (farm and off-farm) income: 1995 to 1997 in reality and in a scenario without direct EU payments

	Poor households	Non-poor households		All households
		poor, based on farm income	non-poor based on farm income	
Historical reference (see table 12.2)				
Share of households (%)	23	21	56	100
Share of farms (%)	23	22	55	100
Simulation scenario without direct payments				
Share of households (%)	27	20	53	100
Share of farms (%)	28	20	52	100

We calculated how many farms would be classified in table 2 as poor, if the EU direct payments to producers would not exist. Table 12.5 shows that in that case (without any change in farm management or direct taxes) 28% of the farms would be classified as poor, compared to 23% with subsidies. The effect would have been higher if we subtracted the income from starch potatoes (where the direct payments are paid to the processor that than pays out a higher product price) and if we modeled a situation without production quotas.

The results of this simulation demonstrates that the agricultural safety net in the Netherlands is better targeted than in the U.S.: it keeps about 4,000 households above the poverty line that we used in these calculations. As this poverty line is much higher than the criteria for the general social safety net, it is unlikely that the number of applications from the agricultural sector for the Assistance program would go up with the same number of households. But even if this would be permanently the case, the uptake of the Assistance program in the agricultural sector would not be much higher than that in the economy as a whole (4%). The uptake would also be comparable with the level in the U.S.

12.5 Conclusions

In the empirical portion of this paper, we analyzed the contribution of current farm direct payments to farm households in both the Netherlands in the U.S. We interpreted these payments as farm safety net premiums, where some will argue that these payments are a (temporary?) support to overcome the reduction of other forms of protection or a payment to reduce pollution or to provide public goods. We did not include other forms of production support (like quotas or import restrictions).

In the Netherlands, farm safety net payments are targeted towards households in the lower end of the income spectrum. This targeting is consistent with what one wants from a safety net, as reviewed in the theoretical portion of this paper. In the U.S., however, this does not hold. As a percentage of total income, farm safety net payments are relatively similar across different income categories. Therefore, these payments do not meet the standards one usually ascribes to a social safety net.

Also in the Netherlands, the system is far from perfect. Partly it is more by chance than design that the EU payments are skewed to the poorest farmers. The horticultural sector, important in the Netherlands and with relatively a low number of poor farmers, enjoys a much lower protection and no direct subsidies. In other sectors, payments are production oriented and deliver a large part of the budget to better-off farmers.

Both countries have general safety nets for their population, for which farmers are eligible and in which they take part. In the U.S., few farm households choose to enter the Food Stamp Program and their participation rates are substantially lower than the population as a whole. While part of this is due to the lower number of eligible households, the primary reason is the lower take-up rate of farm households. In the Netherlands, a larger percentage of farm households are classified as 'poor' in research commissioned by the government, but only a small percentage of farmers take part in the Assistance program. The participation rate is clearly lower than in the U.S. Food Stamp Program even if participation in similar programs (e.g. IOAZ) are included. It is not clear if this is due to the differences in the definition of 'farmer', the more specialized character of Dutch farming, or the Dutch income tax and pension system.

The removal of the farm safety net in the U.S. would lead to about a 3 percentage point increase in the number of farm households eligible for food stamps. This small change is primarily due to the low level of support lower-income farmers are getting in the current system. In the Netherlands, however, farm safety net payments constitute, on average, 60% of poor farm households farm income and about one third of their total income. If EU direct payments were abolished, the number of farmers classified as poor would increase from 23 to 28 %. It is impossible to estimate how many extra farmers ould apply for the Assistance program. As most farmers taking part in this program are from farm types without much investments in land, and direct payments are at the moment in the Netherlands focussed on arable production (including silage maize with livestock farmers), the increase is probably very modest. But even if this would not be the case, and the five percent point increase (equivalent with 4,000 farmers) would apply for the Assistance program, the take-up rate of the program in the agricultural sector would be in line with the uptake in the economy as a whole, and would be comparable to the situation in the U.S.

In this paper we considered whether a general safety net could replace an agricultural safety net. Based on analyses of the current distribution of payments, the effect of abolishment of the agricultural safety net, and on the analysis of data from the general safety net, we question the efficacy of the agricultural safety net. In the U.S. the farm safety net does not work as a safety net. In the Netherlands it does, but not very efficiently, especially if one takes non-farm income and taxes into account. In both countries the general safety net functions also for farmers, although participation amongst farmers is very low. It is unclear to what extent this is due to the design of the general safety net procedures which might neglect specific agricultural characteristics and due to a presumption that farmers are already covered by the agricultural safety net. The cross-country situation seems not to be influenced by country-specific circumstances as farm size, farm structure, degree of specialization / non-farm income, or general level of equality and social welfare.

The analyses in this paper illustrates again the importance of having good household level data. Without this data, the analyses here could not be performed. We wish to point out, however, that the number of farm households in the surveys for the general population are often quite low, reflecting the decline in the number of farm households. One way to address this problem is to oversample farm households. Conversely, while household-level farm data has a rich assortment of information not available on surveys for the general population, they are lacking in information on participation in non-farm safety net programs. As the farm safety net diminishes in countries, the inclusion of these questions will become increasingly relevant.

Except when relevant to the eligibility criteria for the various assistance programs, we have not analyzed the role of assets and wealth in the well-being of farm households. As demonstrated by others (e.g. Hill, 1986), their roles can be fairly substantial insofar as they enable consumption smoothing options not available to other households. The presence of these consumption smoothing opportunities may diminish a household's need for assistance programs and, perhaps, explains their low participation rates. Further research is needed on this topic.

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Workgroup Session IV: The EoI and Representativity and comparison with other countries/first steps to do

Instructions

Task: Review results on the working package from the previous sessions, and add additional projects and stakeholders if needed from the point of view of the representativity and international comparison perspective. Make a list of the first steps to do if you would be responsible for the working package tomorrow. Write them on a flipchart and a blank sheet for presentation.

Group A
Working Package: Using new ICT opportunities to improve efficiency of current FADN systems

Group B
Working Package: Changing information requirements in FADNs as policy issues change

Group C
Working Package: Sharing data between different stakeholders like the regional, national and EU level, with effects on harmonising and conversion and a reduction in the administrative burden.

Group D
Working Package: Using improved data by better modelling for even better information products for farmers and policy makers

Group E
Working Package: Platform to bring professionals together to learn from each other, especially between old, new and potential EU members as well as with trading partners like the USA.

Groups for the workgroup session
'The EoI and Representativity and comparison with other countries / first steps to do'

Group A - Using new ICT opportunities to improve efficiency of current FADN systems
C. Gundersen (chairperson)
A. Kinsella (reporter)
S. Schiavon
T. Borbas
F. Arfini

Group B - Changing information requirements in FADNs as policy issues change
B. Del'homme (chairperson)
P. Doria (reporter)
M. Aamisepp
B. Meijer
G. Lech
U. Toic

Groep C - Sharing data between different stakeholders
M. Lekesova (chairperson)
C. San Juan (reporter)
K. Boone
M. Merlo
A. Fais

Group D - Using improved data by better modelling for better information products
A. de Cicco (chairperson)
H. Vrolijk (reporter)
V. Bratka
A. Karlsson
A. Szelagowska
P. Nino

Group E - Platform to bring professionals together to learn from each other
G. Bonati (chairperson)
P. Jägersberg (reporter)
Z. Kubikova
I. Martini
A. Varendi
A. Povellato

GROUP A

Using new ICT opportunities to improve efficiency of current FADN systems

* direct link {projects 1& 3}
* skip patterns {projects 1 & 3}

* co-ordinating data between different sources {project 2 & 4}
* save farmers time {& project 5}

GROUP B

* Prepare the 'data dictionary'
* In order to compare need for harmonisation of methodology
* Create a network for people responsible for the new aspects in each country involved

Main question: solution for the trade-off between

Several specialized DB (representativity problems)	vs	FADN getting bigger and bigger (refusal)
	solution	

New idea
farms in specialised DB as subsamples of FADN

B Changing information requirements as policychange

1. How to manage and integrate already existing environmental data (water irregation system: water use in different regions)

2. Investigate the possibilities to collect new data

3. Comparison of data on pesticide use (Holland) with indirect statistics

   Deliverable: report with costs and benefits indirect methods

4. Investigate the possibilities to connect data from FADN and IACS - landschape

5. New data: farm location and land use integrated with geographic data

6. New agricultural activities

Deliverable: data in database

7. Qualityproducts

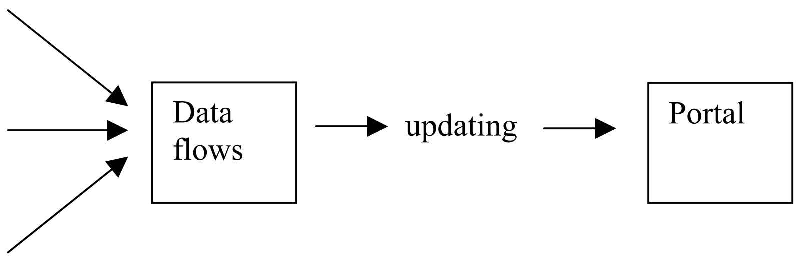
Deliverable: report on experiment for Italy

Stakeholders:
farmers, government, local government, EU policymakers, researchers, consumers

GROUP C

Sharing data different stakeholders

1. To exploit internet possibilities:
   a. identify the client wishes: - questionare
      - interviews
   b. project plan
      1. what
      2. when
      3. how
      4. resources
   c. common internet session with stakeholders
      - start interaction: brainstorm
      - ... the plataform & validate
   d. find someone to built the plataform & define the network



2. ICT diffusion: ● to stimulate farmers to provide new data

→ marketing strategy to stimulate farmers to buy a computer

→ access to interesting information
- subsidies
- new crop technology
- cost standards

● to stimulate institutions to provide

back information institutional organization:
- technical support
- taxes advertising

GROUP D

Management risk with FADN data

- make a clear problem definition
- make some phonecalls in personal network
- internet search/literature review
- create project team/commitment
- identify - existing tools
  - available data

GROUP E

Platform to bring professionals together

1. Analyse the needs of the experts groups, features, needs, charactaristics
2. Identify a computing platform
3. Ensure interactive content management
4. Ensure promotion of the website
5. Identify a person in charge of the website maintenance
6. Ensure translation
7. Provide user-friendlyness and easy access of knowledge for a huge user group

13. FADN CZ SOFTWARE in 2002

Michaela Lekesova, Vuze, Czech Republic

Abstract

The design of FADN CZ was elaborated in 1994. Since 1996 two databases had gathered data from two main types of farms - legal entities and individual farms.

Two different SW were used for collecting data by accountancy offices, one for legal entities and one for individual farms. These SW were created with different input data structure.

Due to the need for changes with respect to the EU requirements a new questionnaire was created for survey 2001. The overall concept of the farm return has not changed. The questionnaire of the FADN CZ contains information resulting from national demands and procedures of the valid Czech accounting legislation and, at the same time, includes all data items necessary for conversion of data into the format required by the EU.

The basic requirement for the FADN CZ SOFTWARE 2001 was to create a complex and consistent information system for collecting and processing of FADN data and management of FADN database.

The architecture of the FADN CZ SOFTWARE 2001 is fully implemented for collection and processing of data on farm level, as well as for distribution and publishing of data, partially also for central data processing. The application solution is modern, effective, prospective, easily operated and less demanding for clients, less dependant on the SW and HW clients' PC.

13.1 Introduction

This paper aims to present the current situation in the Czech Republic, where FADN needed to be set up for CR to enter the EU. It focuses on the changes of methodology and mainly data processing system, which were harmonized with EU requirements. The paper reviews the key message from past work on FADN CZ SOFTWARE in 2001, including some observations from Czech experience.

13.2 Previous situation

The design of FADN CZ was elaborated in 1994 and was derived only partially from available EU methodologies. In terms of collected data this system was derived from accounting procedures used in Czech agricultural enterprises without principal modifications and changes of the accounting procedures of farmers.

Since 1996 two databases had gathered data from two main types of farms: one type called legal entities, corresponding to farms using double entry bookkeeping including cooperatives and companies (representing 3,000 entities operating in CR, 1,500 of them being cooperatives), but also individual farms using double entry bookkeeping. Another type called individual farms corresponding to small farms using simple entry bookkeeping (representing between 30,000 and 100,000 entities operating in CR).

Two different SW were used for collecting data by accountancy offices, one for legal entities and one for individual farms.

These SW were created with different input data structure, which depends on the type of bookkeeping and these SW applications were installed on a PCs located at accountancy offices.

The first database was for legal entities. It was developed under Paradox with MS-DOS environment. The database for individual farms was developed at first under Paradox with MS-DOS environment and later under FOXPRO with Windows environment.

There was possibility to use a converting program from different bookkeeping software into databases in both SW.

13.3 Description of the new system

13.3.1 Changes in the content of the FADN CZ survey - new questionnaire 2001

Full harmonisation of the content of the survey in the FADN CZ according to EU requirements required a completely new questionnaire, including many formal changes. The overall concept of the farm return has not changed. The questionnaire of the FADN CZ contains information resulting from national demands and procedures of the valid Czech accounting legislation and, at the same time, includes all data items necessary for conversion of data into the format required by the EU. The volume of entirely new additional data items is relatively small.

As regards the formal viewpoint, there has been reached considerable approximation of the questionnaire for legal entities and individual farms and the bulk of the questionnaire is uniform for both legal types of farms.

13.3.2 New system of data processing - FADN CZ SOFTWARE 2001

One of the principal ongoing changes was development of a new system and software for collection, checking, processing and FADN CZ database utilisation.

The basic requirement for the FADN CZ SOFTWARE 2001 was to create a complex and consistent information system for collecting and processing of FADN data and management of FADN database.

13.3.2.1 Functions of the FADN CZ SOFTWARE 2001 information system

On the basis of requirements for the information system and the structure of users the system, analysis of the functions provided by the system was carried out.

Basic functions implemented in the information system in question are:

- collection and data processing on farm level:

    - collection, editing and checking of data for legal entities according to rules of the Czech Republic and the EU;
    - collection, editing and checking of data for individual farms according to rules of the Czech Republic and the EU;
    - data analysis at farm level, including local checking and outputs;
    - simple transmission of data to the centre.
- central data processing:
    - administration of the database of the network.
    - import of typed data.
    - checking of data.
    - processing of farm typology.
    - data processing.
    - secure, protected saving and storage of data.
- generation of outputs and presentation of FADN CZ database:
    - generation of outputs according to CZ methodology;
    - generation of outputs according to EU methodology;
    - implementation of database query system for privileged users;
    - implementation of database query system for publicly available data.

The architecture of FADN CZ SOFTWARE 2001 is derived from the process analysis which defines two basic processes.

a. *Data storage*
   The central database was created. The FADN CZ SOFTWARE 2001 information system administers a great volume of data requiring high security and access requirements. Therefore, it is necessary to use a powerful and accessible SQL server for data storage and its administration. In this case the MS SQL server 2000 has been used.
b. *Data processing*
   Independent applications have been developed on the principle of web technology, i.e. the architecture is based on HTML, XML, ASP, VBS and JAVA SCRIPT languages accessible through Internet browser (optimised for MS Internet Explorer). In addition, the properties and mechanisms of the system's own SQL server have been used.

Communication within this architecture between individual processes is on-line with internet access either as extranet (editing of data and provision of data for specific groups), intranet (checking, processing and provision of data for specific accesses) or Internet (provision of publicly accessible data).

The above-mentioned structure may be called 'www on-line'. This architecture is the basic backbone of the whole system.

Principle of the 'www On-line' solution:
- www application with the use of ASP, JavaScript and VB Script technology and the system's own HTML;
- these applications process the data and data core of the central SQL server;

- applications are installed on the central web server;
- applications run and the client works in Internet Explorer on the local PC or web terminal.

The mentioned architecture is fully implemented for collection and processing of data on farm level, as well as for distribution and publishing of data, partially also for central data processing. The 'www On-line' application solution is modern, effective, prospective, easily operated and less demanding for clients, less dependant on the SW and HW clients' PC.

Some clients, mainly those on the data supplier side, have problems with connection to the Internet. Therefore, it was necessary to create for collection of data a local application, 'www OFF-line', which can be individually installed. It supposes using 'www OFF-line' version at users.

Utilisation of 'www OFF-line' version is anticipated also for the users who convert data from different bookkeeping software.

This solution is derived from identical architecture of the system, which is also applied for this local application.

Principle of the 'www Off-line' solution

- www application with the use of ASP, JavaScript and VB Script technology and the system's own HTML;
- this application works with the data and data core of the compatible SQL format (MS Access);
- the application is installed on a local www server which represents Personal Web Server;
- the application runs and as a client part works in Internet Explorer.

13.3.2.2 Implementation of the information system

The FADN CZ SOFTWARE 2001 is designed on a modular basis as mutually collaborating from the viewpoint of users, however, in the form of independent modules.

SW APPLICATION		*Access to application*	*Type of application*
MODULE1+2	SW applications for data processing on farm level for legal entities and individual farmers	Local PC Internet PC	www Off-line www On-line
MODULE3	Central database	SERVER	SQL
MODULE4	System of input into database	Intranet PC	www On-line SQL
MODULE5	System of control and processing of standard outputs	Intranet PC SQL	www On-line SQL Export dbf
MODULE6	System of farm typology	Local PC Intranet PC	www Off-line www On-line
MODULE7	System of general outputs and presentation of data	Internet PC	www On-line SQL

Functions of individual modules

MODULE1+2	input of data for legal entities (manual import of data) input of data for individual farmers (manual import of data) local checking at the level of agricultural enterprise local analyses and reports at the level of agricultural enterprise import of data from other accounting systems sending data in the centre
MODULE3	basic database model general structure of data verification of data security of data , storing of data setting of access rights
MODULE4	import of farm data into database checking during import blocking of inconsistent data batch processing of import
MODULE5	complete checking of data for consistency and content central checking over all agricultural enterprises generation of standard outputs for Green Report, EU data set
MODULE6	input typology data at farm and central database level SGM calculation and storage procedures for classification output at the farm and whole database level
MODULE7	definition of publicly accessible database and database for privileged users data security easy and permanent data access

The supplier of FADN CZ SOFTWARE 2001 is consortium of the project team represented by the firm Umbriel.

13.4 The experience from the application of FADN CZ SOFTWARE 2001 on survey 2001

13.4.1 Advantages

The new software was successfully used on processing at FADN CZ survey 2001. The basic objective - harmonization of the Czech FADN data with EU format has been reached.

Why do we find this solution positive?

No distribution of software is necessary and no more requirements (relating software on PCs) are foreseen. Each user has to have only Internet Explorer (4.0 and higher).

The solution is general and flexible, i.e. no changes of the application have to be made if the structure of input data has changed.

The liaison agency (VUZE) has access to edited and checked data and can help data collectors with data collecting and processing on farm level. This should significantly increase quality of data and shorten timetable of data collecting.

All subject - data collectors, central processing team and data users have access to FADN CZ database and software for utilization of this database - for example Typology, calculation of cost production etc.

The authorized users can define their own criteria for selection of farms no matter what type of farm is mentioned (legal entities and individual farms). It is possible to define the structure of output data including aggregation criteria.

13.4.2 Disadvantage of this solution

The development of FADN CZ SOFTWARE was our first experience with SQL server. Therefore programming of some parts of application especially checking procedures was not quite efficient.

Consequently the download checking procedures were slower and some users had problems during checking data. New controlling program will be updated in new version of software.

The performance of data server VUZE was not sufficient. At the end of the survey 2001 when many clients were connected at the same time and were checking data, the server was not capable of managing so many users.

We have bought a new powerful server with two processors for FADN CZ database management.

Some data collectors had problems with efficiency and reliability of their internet connection and they spent a lot of time with editing of data on-line. The off line version was demanding on HW as well as on computer skill for its installation. We are developing for next survey very simple editor for input data without any checking procedures. It will allow local input data and easy upload of data into on line version. All controls and corrections will be performed in on line version. This application will be based on MS Access.

We came out of our experience and facts achieved in course of survey in this year and hope the survey FADN CZ 2002 will run without any problems relating software and data server.

13.5 Conclusions

Survey FADN CZ 2001 has been carried out on improved methodology and on new system of data collection, processing and presentation.

VUZE succeeded in implementing of the full harmonisation the content of the survey in the FADN CZ to EU requirements and new system of data processing software. The application solution is modern, effective, prospective, easily operated and less demanding for clients, less dependant on the SW and HW clients' PC.

There were certain reserves in the software solution as well hardware. Insufficient exploitation of tools of SQL Server and an absence of a performing hardware caused problems during data processing. Solution of these problems shall bring excellent new ways and methods for FADN survey.

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14. Costs of Production for Milk in the European Union based on FADN data

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14.1 The sample

The costs of production for milk in the European Union (EU) were considered on the basis of FADN data. The sample is made up of the dairy farms (output coming from the dairy animals > 60% of the total output of the farm) having taken part in the FADN during the accounting year 1998/99. Thus 4,500 specialised dairy farms has been selected in the EU-15. Results are expressed in current market ecus and by quintal (100 kg) of milk, except if otherwise indicated.

14.2 The calculation of the costs

Two measures of costs were retained:

1. *The total of inputs*. In this approach, one takes account only of the costs having given rise to effective expenditure (purchases of food and of fertilizers, payment of wages and of the overheads, etc.), but also of the depreciation. That means that the returns of production factors owned by the family (work, land, capital) are not included. With this measure of the costs, the identified margin (difference between the received price and the costs) represents therefore the family's remuneration coming directly from the dairy activity.
2. *The total costs*. In this case, the remuneration of the family factors was considered and was added to the total of the inputs. This is always a difficulte exercise, but is proved necessary, because the proportion of the family factors in the total of the factors varies very extremely from one country to another. The family production factors were therefore valued by the attribution of imputed wages, of an imputed rent and of opportunity remuneration of the equity capital.

14.3 Attribution of costs to the dairy enterprise of the farm

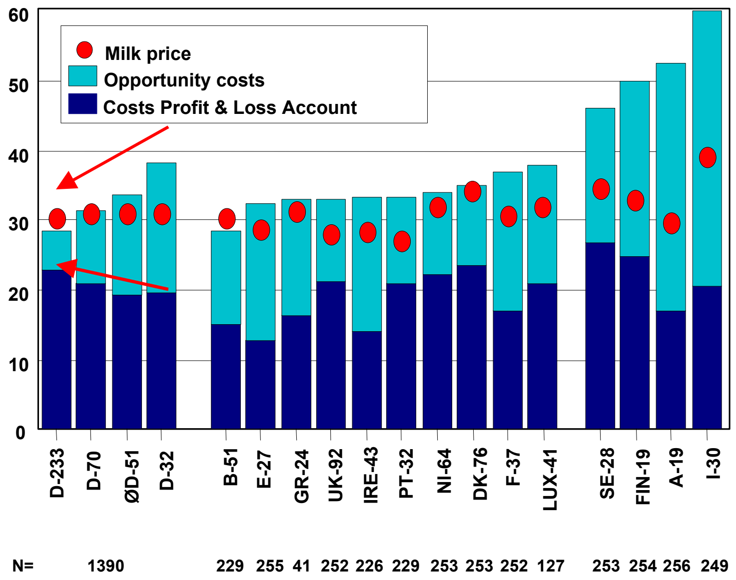
Allocation factors:

1. Attribution of land costs as well as forrage costs excluded labour- and machinery costs due to the variable 'share of forrage area on the total agricultural area'.
2. Attribution of labour, capital and depreciation as well as overhead costs due to the variable 'share of milk output on the farm's total output'.

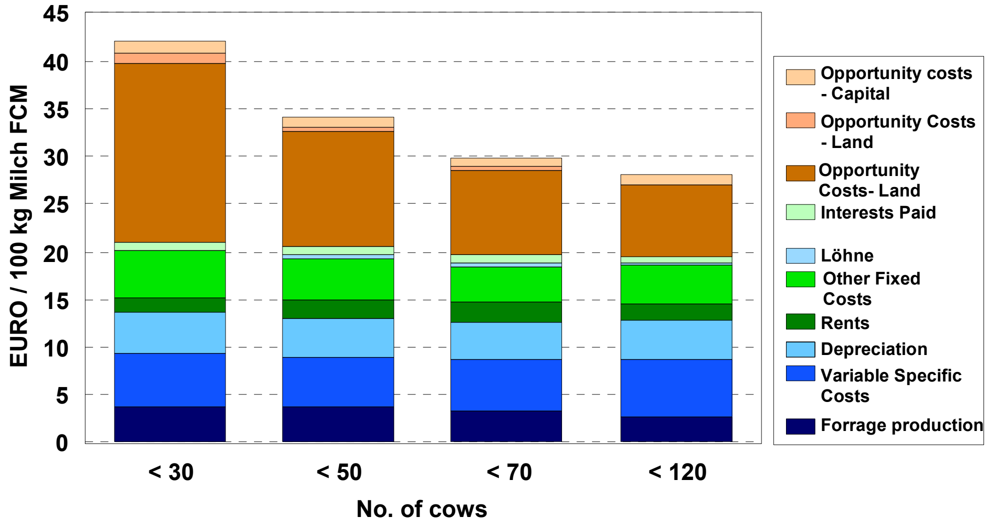
3. Attribution of animal specific costs due to the variable 'share of dairy cattle on total cattle'. This allocation factor has been choosen due to the fact, that within the animal specific costs no difference between dairy cattle and other cattle can be drawn.
4. Specific costs linked to the dairy enterprise has been totally attributed.

14.4 First results FADN

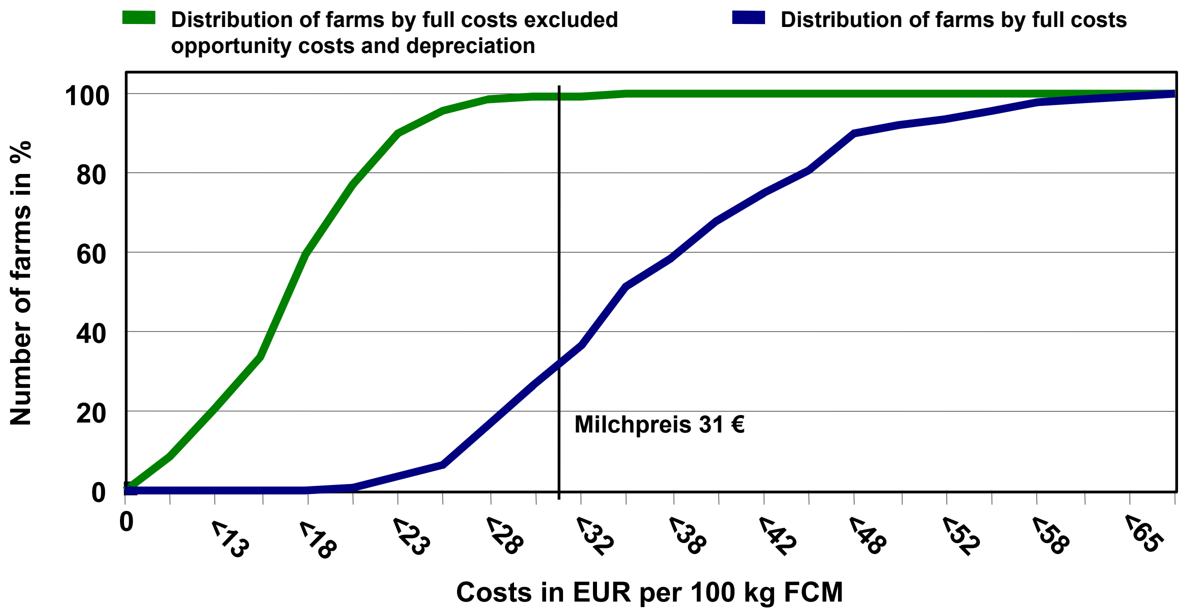
Milk production costs in EU-countries



Production costs by herd size, France



Cumulative distribution of dairy farms, sorted by full costs and full costs minus opportunity costs and depreciation (Example: France)



Source: Own calculations on the basis of INLB-EU-GD Agri/A.3 (1998/99).

Petra Jägersberg

Federal Agriculture
Research Centre

Institute of Farm Economics
and Rural Studies

Costs of Production for milk in the European Union

On the basis of FADN data, Accounting year 1998/99

Database

Method

Cost Allocation

First results

Database

- FADN:
  - Specialised dairy farms
    (60 % output coming from dairy animals)
  - Jahr 1998/99
  - 4.520 Betriebe (EU-15)

Method

Costs of dairy production

- Full costs approach including the remuneration of family factors
- Consideration of side returns
- Attribution of cost components to the dairy enterprise
- Calculation without VAT
- Results expressed in current market ecus and by quintal (100 kg) of milk

FAL

Attribution of costs to the dairy enterprise

Allocation variables

- Land + forrage costs excluded labour and machinery costs by the variable: „Share of forrage area on the total UAA“
- Labour + Capital + Depreciation: „Share of milk output to the farm´s total output“
- Animal specific costs: „Share of dairy cattle on total cattle“
- Variable specific costs fully attributed to dairy production

FAL

Database

Method

Cost Allocation

First results

Remuneration of family production factors

- Labour: country specific wage from EDF database
- Land: country specific rent from EDF database
- Capital: 3% interest rate on own capital

FAL

Database

Method

Cost Allocation

First results

First results FADN

- Distribution of dairy farms
- Full costs of dairy production by herd size, region, milk yield, milk quantity
- Average costs per EU-member state and production technical indicators

FAL

Database

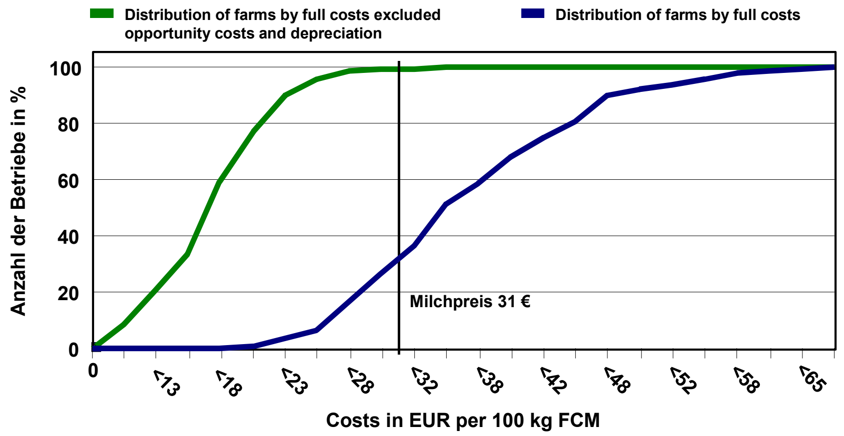
Method

Cost Allocation

First results

First results FADN

Cumulative distribution of dairy farms, sorted by full costs and full costs minus opportunity costs and depreciation (Example: France)



Source: Own calculations on the basis of INLB-EU-GD Agri/A.3 (1998/99).

FAL

Database

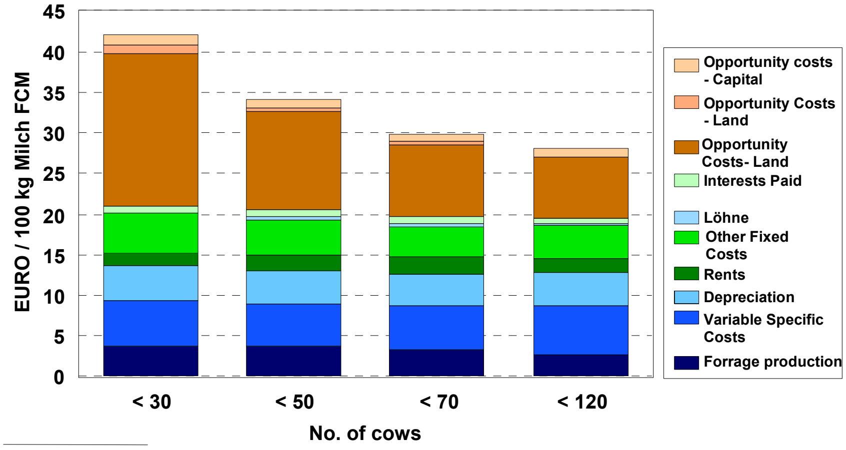
Method

Cost Allocation

First results

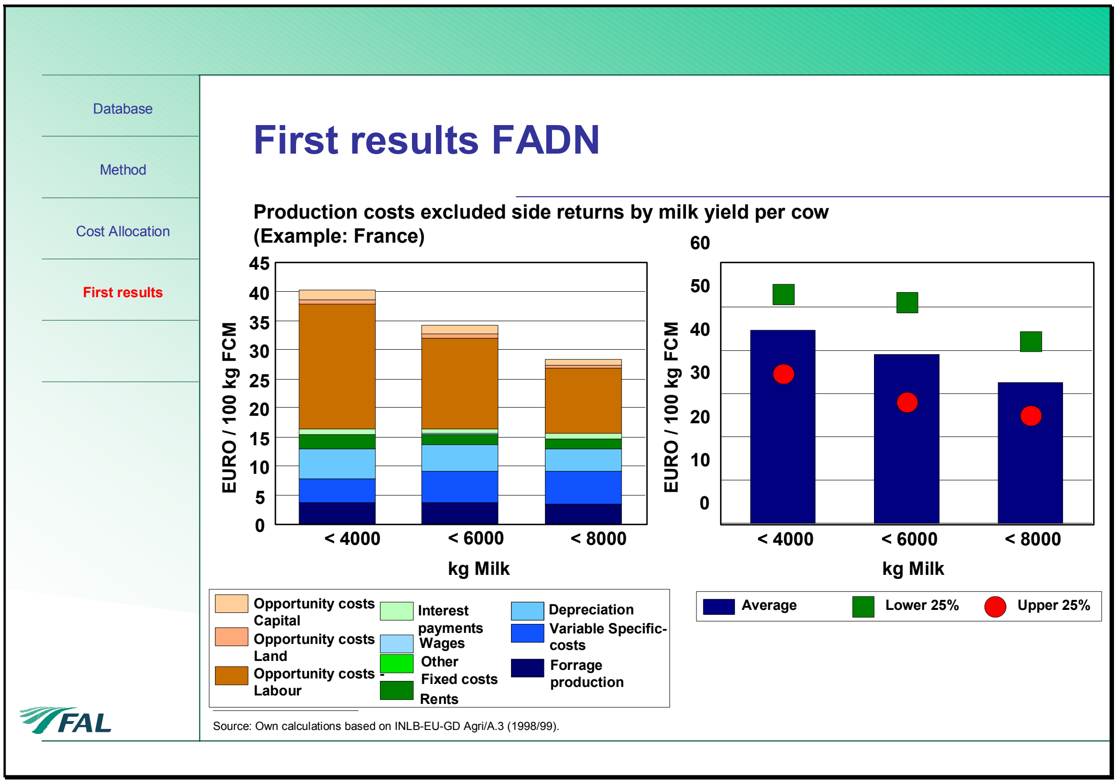
First results FADN

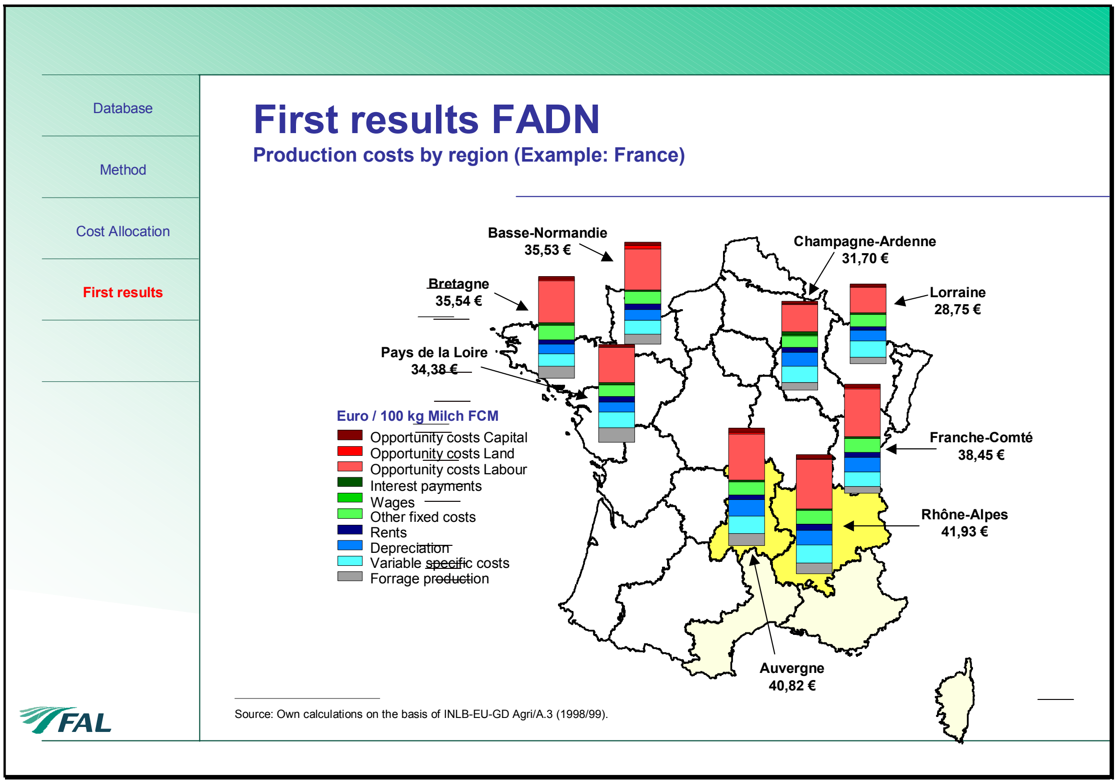
Production costs by herd size (Example: France)



Source: Own calculations based on INLB-EU-GD Agri/A.3 (1998/99).

FAL


Database
Method
Cost Allocation
First results
FAL
First results FADN
Production costs excluded side returns by milk yield per cow
(Example: France)
EURO / 100 kg FCM
45
40
35
30
25
20
15
10
5
0
< 4000
< 6000
< 8000
kg Milk
60
50
40
30
20
10
0
< 4000
< 6000
< 8000
kg Milk
Opportunity costs Capital
Opportunity costs Land
Opportunity costs - Labour
Interest payments
Wages
Other Fixed costs
Rents
Depreciation
Variable Specific-costs
Forrage production
Average
Lower 25%
Upper 25%
Source: Own calculations based on INLB-EU-GD Agri/A.3 (1998/99).


Database
Method
Cost Allocation
First results
FAL
First results FADN
Production costs by region (Example: France)
Basse-Normandie
35,53 €
Champagne-Ardenne
31,70 €
Bretagne
35,54 €
Lorraine
28,75 €
Pays de la Loire
34,38 €
Franche-Comté
38,45 €
Rhône-Alpes
41,93 €
Auvergne
40,82 €
Euro / 100 kg Milch FCM
Opportunity costs Capital
Opportunity costs Land
Opportunity costs Labour
Interest payments
Wages
Other fixed costs
Rents
Depreciation
Variable specific costs
Forage production
Source: Own calculations on the basis of INLB-EU-GD Agri/A.3 (1998/99).

Database

Method

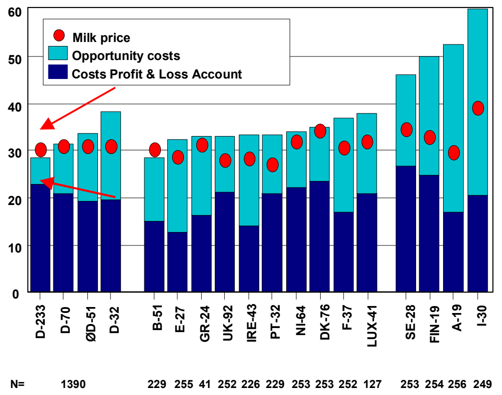
Cost allocation

First results

FAL

First results FADN

Milk production costs in EU-countries



Database

Method

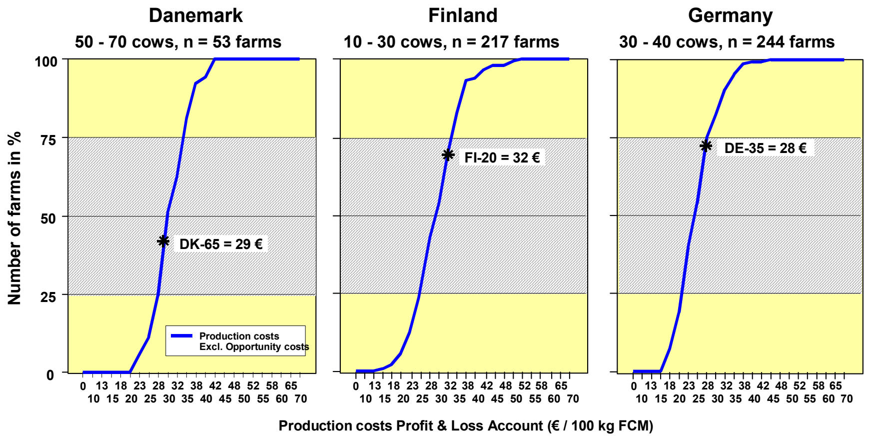
Cost Allocation

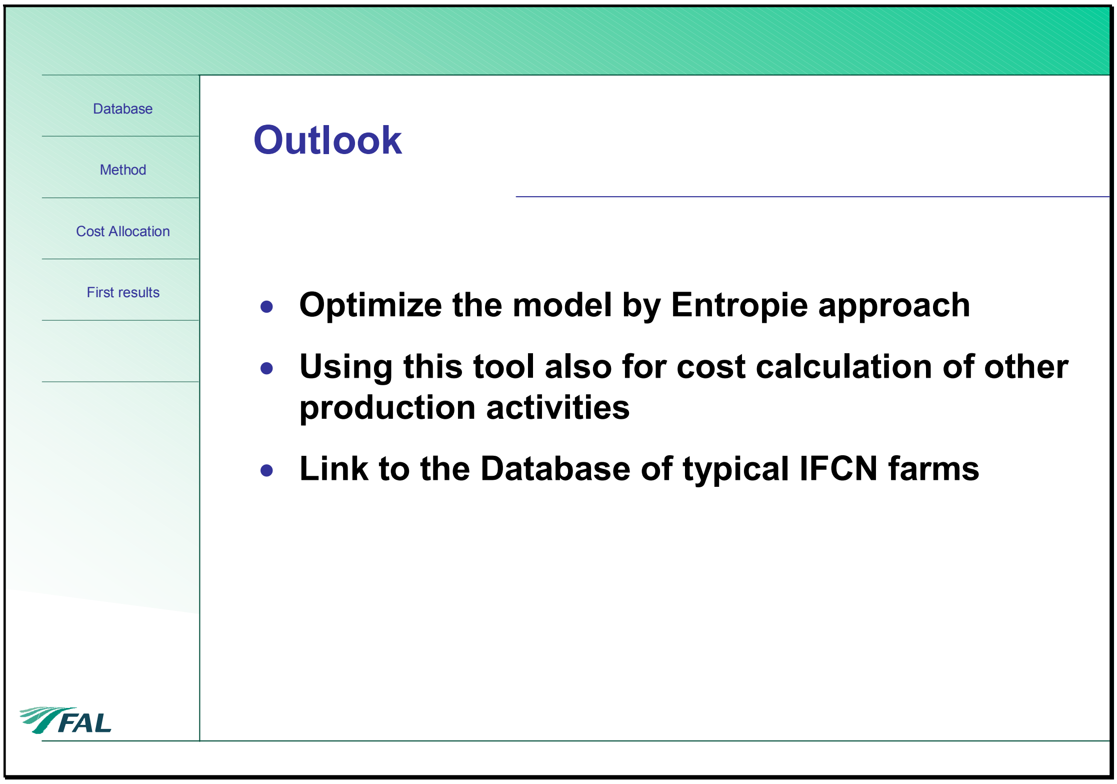
First results

FAL

Comparison of farm data with FADN and IFCN approach

Comparison of typical IFCN farms with the cumulative distribution of production costs based on FADN farms




Database
Method
Cost Allocation
First results
Outlook
Optimize the model by Entropie approach
Using this tool also for cost calculation of other production activities
Link to the Database of typical IFCN farms
FAL

15. Social corporate responsibility and FADN

Koen Boone, LEI, The Netherlands

LEI WAGENINGEN UR

Social Corporate Responsibility - History

- Milton Friedmann (1972):

  "The social responsibility of business is to increase its profit"….
  …"As long as it stays within the rules of the games"

- World Commission on Environment and Development (Commission Brundtland, 1987): "Our common future"
  - Harmony between people, and between people and nature

  Definition: Satisfy needs of the current generation without threatening the possibilities for future generations to satisfy their needs"

- Bodyshop (1995):
  "To dedicate our business to the pursuit of social and environmental change"

- OECD: Guidelines for multinational enterprises

LEI WAGENINGEN UR

SCR-definition

SER (the Netherlands):
- Create value for society

Dutch government:
- Do more than laid down in the law

Possible interpretations of SCR:

1. Report about the company (transparency)

2. Sustainability of society (carrying capacity, stock and flow, objective)

3. Do business in a way that society desires (stakeholder perspective, subjective)

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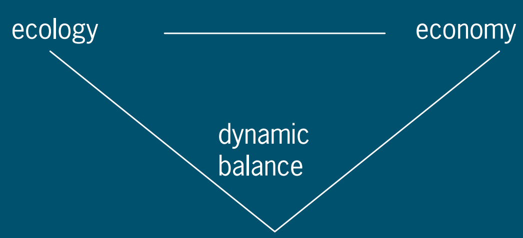
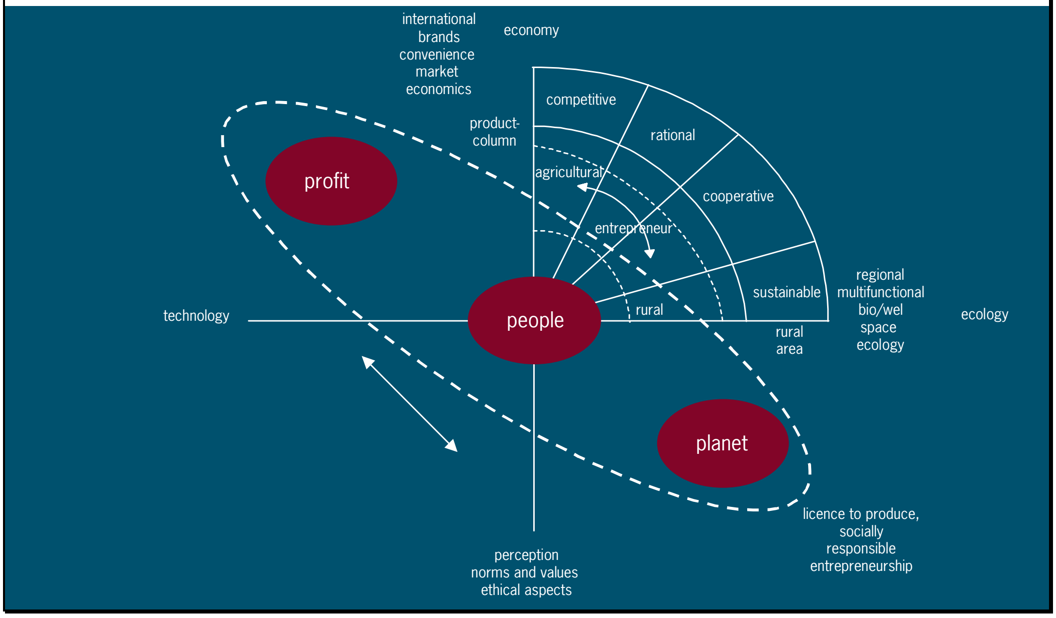
People, Planet, Profit

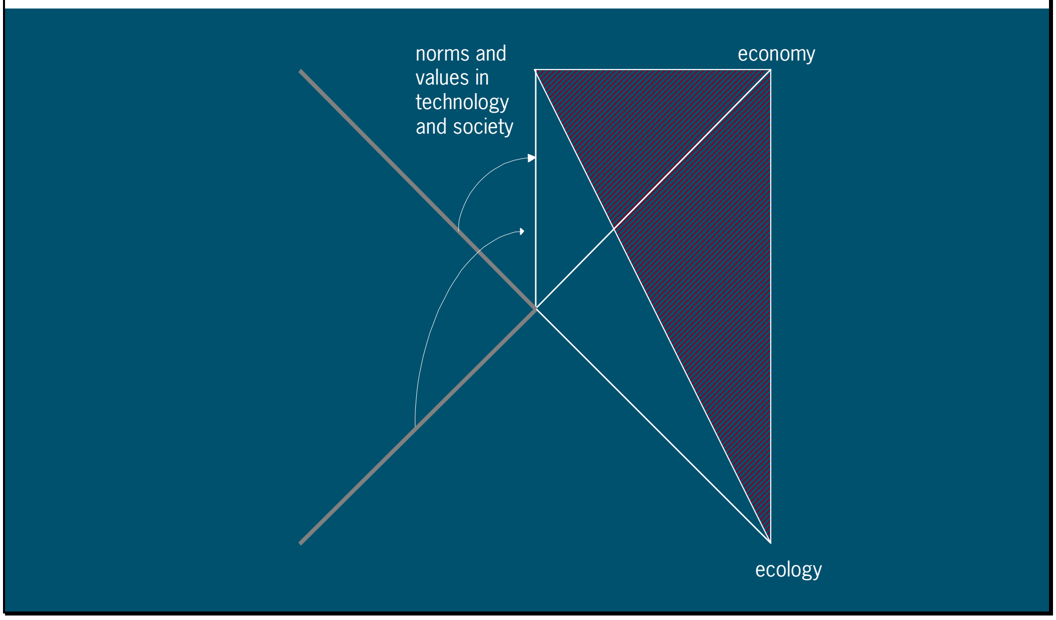


Norms and values in technology and society

Licence to produce



Optimize 3 P's



Social Corporate Performance

Wood:

- Motives, principles
- Processes and policies
- Impact

- Global Reporting Initiative (GRI)

  - Initiative of US Coalition of Environmentally Responsible Economies (CERES) and UN (1997)
  - Goal: Improve the quality of sustainable reporting
  - Participants: businesses, accounting bodies, investor organisations, trade unions etc.
  - September 2002: new guidelines
  - Vision, Profile, Processes and Performance

SCP in practice

Selection for ethical investment funds (listed stocks):

- Dow Jones Sustainability Index
  - Annual reports
  - Questionnaire: a lot of questions about vision and processes
- Arese, Banque Sarasin and FTSE4Good

Agriculture:

- European Commission: environmental indicators (2001)
- OECD: Environmental indicators (2000)
- EC and OECD: Projects started for social/people indicators

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SCP and agriculture

Agricultural themes:

- Specific environmental indicators
- Food safety
- Animal welfare
- Animal health
- GMO

Lei (2002):
- Questionnaire for measuring sustainability of project proposals
- SCP benchmark study for Dairy Industry

However:
- No indicators on all themes yet
- No weighting and integration yet

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SCP and FADN

- EC environmental indicators
  EU-FADN can be used for 4 out of 35 indicators

- LEI Ecological indicator (environment and nature/landscape)
  Dutch FADN can be used for about 2/3 of indicators

However:
- Hardly any indicators available about “People”
- No information about Vision and only partly about Processes (quality marks etc.)

Discussion:
- Should FADN be used for measuring SCP?
- How could FADN be improved for this purpose?

Workgroup Session V: The EoI and FADN implementation in Candidate Countries/know how needed

Instructions

Task: Review results on the working package from the previous sessions, and add additional projects, stakeholders and first steps if needed from the point of view of candidate countries.
Then make a list of the know-how needed in the working package (e.g. accountancy, informatics, auditing, econometrics, public administration). Folowed by a list of 1-3 performance indicators that can be used to see if we reach the objective of the working package (e.g. new technologies implemented in one year, new data available at request etc). Write them on a flipchart and a blank sheet for presentation.

Group A
Working Package: Using new ICT opportunities to improve efficiency of current FADN systems.

Group B
Working Package: Changing information requirements in FADNs as policy issues change.

Group C
Working Package: Sharing data between different stakeholders like the regional, national and EU level, with effects on harmonising and conversion and a reduction in the administrative burden.

Group D
Working Package: Using improved data by better modelling for even better information products for farmers and policy makers.

Group E
Working Package: Platform to bring professionals together to learn from each other, especially between old, new and potential EU members as well as with trading partners like the USA.

Groups for the workgroup session
'The EoI and FADN implementation in Candidate Countries / know how needed'

Group A - Using new ICT opportunities to improve efficiency of current FADN systems
M. Aamisepp (chairperson)
A. Fais (reporter)
B. Del'homme
P. Doria

Group B - Changing information requirements in FADNs as policy issues change
A. Szelagowska (chairperson)
M. Lekesova (reporter)
A. Povellato
A. Kinsella

Groep C - Sharing data between different stakeholders
B. Meier (chairperson)
F. Arfini (reporter)
A. Karlsson
S. Schiavon
P. Nino
Z. Kubikova

Group D - Using improved data by better modelling for better information products
U. Toic (chairperson)
I. Martini (reporter)
C. San Juan
G. Bonati
P. Jägersberg
A. Varendi

Group E - Platform to bring professionals together to learn from each other
V. Bratka (chairperson)
L. Gorai (reporter)
H. Vrolijk
K. Boone
A. de Cicco
T. Borbas

A. Use of ICT - opportunities

general assumptions

in candidate countries new ICT technologies can be helpful only if it accompanies management task.

ICT training for staff
DL - training cources
STF - FADN regional and national staff

1. Hand computer for FADN data collectors

2. Data integration of the already existing DB to build -up FADN - IACS - farm register - and register

3. Portal information
- public access to local information

4. Local information: with Landparcel Information Systems (Prod. blocks), Cadaster, GPS, GIS

Knowledge for users

A. Software for sample design
and extraction - data processing

B. GIS for data integration
inter/intranet for data exchange

B Chaning information requirements as policychange

ENV 1. How to manage and integrate already existing environmental data (water irrigation system: water use in different regions)

NEW 2. Investigate the possibilities to collect new data

ENV 3. Comparison of data on pesticide use (Holland) with indirect statistics
Deliverable: report with costs and benefits indirect methods

ADM 4. Investigate the possibilities to connect data from FADN and IACS - landscape

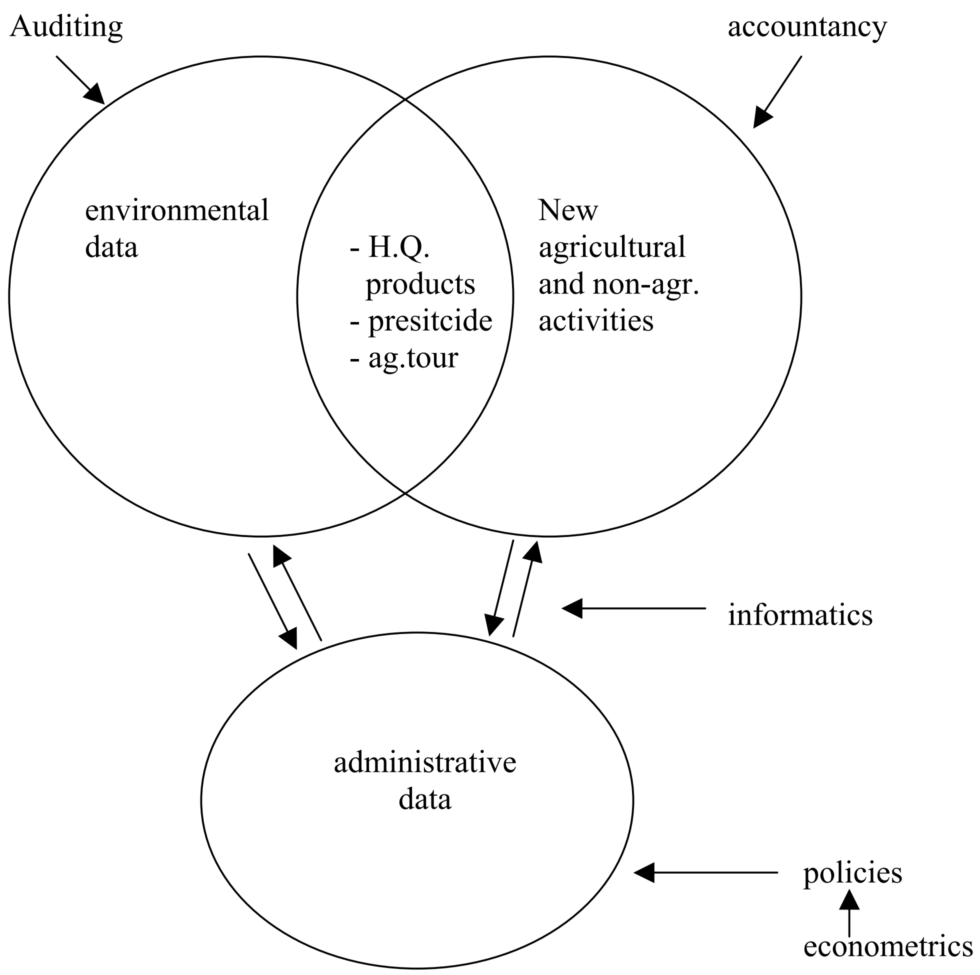
ENV 5. New data: farm location and land use integrated with geographic data

NEW 6. New agricultural activities
Deliverable: data in database

NEW 7. Qualityproducts
Deliverable: report on experiment for Italy

Stakeholders:
farmers, government, local government, EU policymakers, researchers, consumers

Group B



Performance indicators

ENV → Number of env. indicators (EU Commission, EEA), supplied by FADN (with help of FADN)

ADM → Conrete integration of different databases (N. of Con.)

NEW → Concrete integration of different databases (n. of connections) (e.g. = fiscal db/household budget survey/producer associations)

Group C

Performance indicator for new projects

1. Auditing

   → information on: - cost of programme
   - specific indicator of programme
   - confidence

2. Service - cost or auditing on
   - quality
   - certify products
   - traceability
   - added value to enter in common market

   → information on:
   % farms audited for X, Y, Z.
   % of product (PDO, organic)
   % of total production
   % consumers who known

Indicators for 'old projects'

- no of - persons
  - hits
  - logins

- number of publications
- number of better political decision
- number of farmer taking better decisions
- number of researcher knowing DSX system or data warehouse
- farmer who know their cost

D. Using improved date for improved modelling and products

1. Deliverable: timely information system
   Indicator: number of days between data collection and full report about farms

2. Deliverable: managing risk using FADN
   Indicator: number of software applications developed

3. Deliverable: cash flow forecast
   Indicator: number of models performed about cash flow

4. Deliverable: GIS with precize location of farm
   Indicator: distance between the target farms in FADN sample and farms really present

5. Deliverable: auditing data at regional level
   Indicator: number of regional audits

6. Deliverable: intelligent collecting date system
   Indicator: decrease of number of errors

E.

Collaboration network
* coordinator
* define needs
  urgent problems
* exchange of experience

Knowledge:
* stackholder in CC
* present situation
* organizing skills

Indicators
* no. of meetings
* no. of participants and no. of represented countries
* evaluation questionaire
  - meetings themselves
  - is FADN improved in country after meetings
* active participation (no. of proposals)
* follow-up of the meetings, changes after meeting

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