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Collecting sustainability data in different organisational settings of the European Farm Accountancy Data Network

The European Farm Accountancy Data Network (FADN) collects detailed financial economic information on a sample of farms in Europe. These data are used intensively for the evaluation of the European Union's Common Agricultural Policy. Owing to changes in policies, there is a need for a broader set of farm level data, especially on the sustainability performance of farms. This paper describes the different types of FADN systems in Europe and evaluates how these types affect the feasibility of collecting sustainability data. In addition to a theoretical evaluation, the practical experiences of collecting sustainability data on more than 1,000 farms in Europe are described. The paper concludes with a discussion on the advantages and challenges of extending the scope of FADN data collection with sustainability data.

Keywords: liaison agency, sustainability indicators, data collection

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Introduction

The European Farm Accountancy Data Network (FADN) provides detailed financial economic information at farm level on more than 80,000 farms in Europe. The data are collected in a systematic way on an annual basis and the information collected for each sample farm contains more than 1,000 variables. FADN contains harmonised farm-level data across Europe: the data elements to be provided to the European Commission (EC) and bookkeeping principles (such as depreciation) are the same in all countries. The data to be uploaded and the exact definition of each data element are defined in the FADN Farm Return (EU, 2010).

Income support is one of the main aims of farm policies in the European Union (EU) and elsewhere and, to provide reliable information on farm incomes in the EU, income is monitored at farm level by Member States in FADN. Until recently, analyses have mainly focused on analysing the economic impacts of policy making (e.g. Vrolijk *et al*., 2010; Jongeneel *et al*., 2016), and FADN is a source of standardised micro-economic data. It provides a wealth of material for analysing variation in farm incomes, differences in the composition of farm incomes, or assessing the impact of changes in agricultural policies at individual farm level (Vrolijk *et al*., 2004).

Owing to changes in the agricultural policies and the increasing societal demands with respect to the economic, environmental and social sustainability of agricultural production, information needs change. An increasing number of studies try to use data from FADN as proxies for environmental variables (Povellata and Longhitano, 2016) or use a limited set of environmental indicators depending on data availability (Coderoni *et al*., 2016). Given the increasing need for data on the sustainability performance of farms (Eurostat, 2011; ECA, 2016), FADN is a potential starting point to collect this kind of information. Several countries already have an extended data collection in their national FADN systems to cover sustainability issues (see, for example, Boone and Dolman, 2010; Dillon *et al*., 2010; Dolman *et al*., 2012; Platteau *et al*., 2014). Types of information that are already collected at national level range from information themes such as irrigation practices, where more than two thirds of the countries already collect some information, to engagement in local community, quality of life and working conditions where only one or even no countries collect this information (Table 1). About one out every five countries already collects data on key environmental variables such as nutrient balance, greenhouse gas emissions and pesticide usage.

The fact that most indicators are already collected in some EU Member States indicates that it is feasible to collect sustainability data in the scope of FADN. Extending this data collection to the EU level is a promising option as FADN is

Table 1: Sustainability information already collected at national level in the European Union.

Type of information	Member States %
Irrigation practices	0.71
Education and training	0.67
Ownership of farm	0.67
Insurances	0.67
Greening	0.61
Age of assets	0.58
Producing under (quality) labels	0.43
Renewable energy production	0.39
Use of legumes	0.36
Use of contracts	0.35
Nutrient balance (quantities)	0.27
Farm succession	0.25
Direct energy use (quantities)	0.25
Semi-natural areas	0.23
Pesticide usage (quantities)	0.22
Greenhouse gas emissions	0.21
Risk management practices	0.17
Water usage (quantities)	0.17
Involvement in farming organisations	0.13
Innovation	0.13
Soil organic matter	0.13
Nitrate leaching management	0.13
Location and distances to parcels	0.13
Sales channels (cooperatives, consumers etc.)	0.13
Soil erosion management	0.08
Working conditions	0.04
Quality of life	0.04
Engagement in local community	0.00

Source: own data

Table 2: Advantages (+) and disadvantages (–) of collecting sustainability data in FADN or a separate environmental network.

Integrated data collection FADN + FLINT	Separate network for environmental variables
(+) Jointness and trade-off between objectives / indicators	(–) No or weak link with economic performance and farm management
(+) Allows integrated policy analysis	(–) No direct link with policies, policy measure more difficult to evaluate
(+) Use of existing procedures and quality mechanisms	(–) Needs to be established (requires time and resources)
(–) Increased complexity of data collection	(+) Possibility to optimise design for specific variables
(–) Possible need to reconsider field of observation	(+) Optimised design results in more reliable estimates
(–) Wide variety of objectives complicates sample design	(+) Burden can be distributed among farmers
(–) Need for re-adjusting current systems and working processes	

Source: own compilation

the only well-established farm level data collection system on the performance of farms in Europe. In exploring this option, it is worthwhile to consider the advantages and disadvantages of doing so (Table 2). To clarify these aspects, a comparison is made between integrating environmental (and social) issues in FADN or setting up a separate environmental data network.

The Farm Return is the point in the entire data chain of FADN where the system is harmonised. All the processes before uploading the data are NOT harmonised. Each country has its own data collection processes, IT infrastructure, organisational design, incentives for farmers etc. (Bradley and Hill, 2015). Although this could be seen as a weakness because it might introduce a methodological bias, in practice it provides important benefits because the data collection system can be adapted to local circumstances. This is crucial because the agricultural sector, taxation rules, legal obligations to keep accounts, use of IT in the agricultural sector and the extent of electronic data exchange differs strongly between countries. Setting up an FADN system requires selecting data sources and designing working processes that fit to these local circumstances.

This paper analyses the extent to which the differences in national FADN systems affect the opportunities to adapt the data collection. This paper will describe the different FADN systems in Europe, will discuss the implications and possibilities of extending data collection with FLINT type of sustainability indicators in the scope of FADN and will describe the practical experiences of collecting sustainability data in the EU Framework 7 project FLINT (Farm-Level Indicators for New Topics in policy evaluation; http://www.flint-fp7.eu).

Different approaches of data collection in Europe

The starting point of an FADN data collection system is the interaction between a data collector (such as a book keeper, farm advisor or researcher) and the individual farmer. The farmer provides all kinds of information (plus supporting documents) to the data collector who does the further processing to complete the accounts for this farm. Based on the completed accounts, the farmer gets a feedback report with a description of the financial economic situation of the farm, and sometimes a benchmark report to compare their own results with those of similar farms.

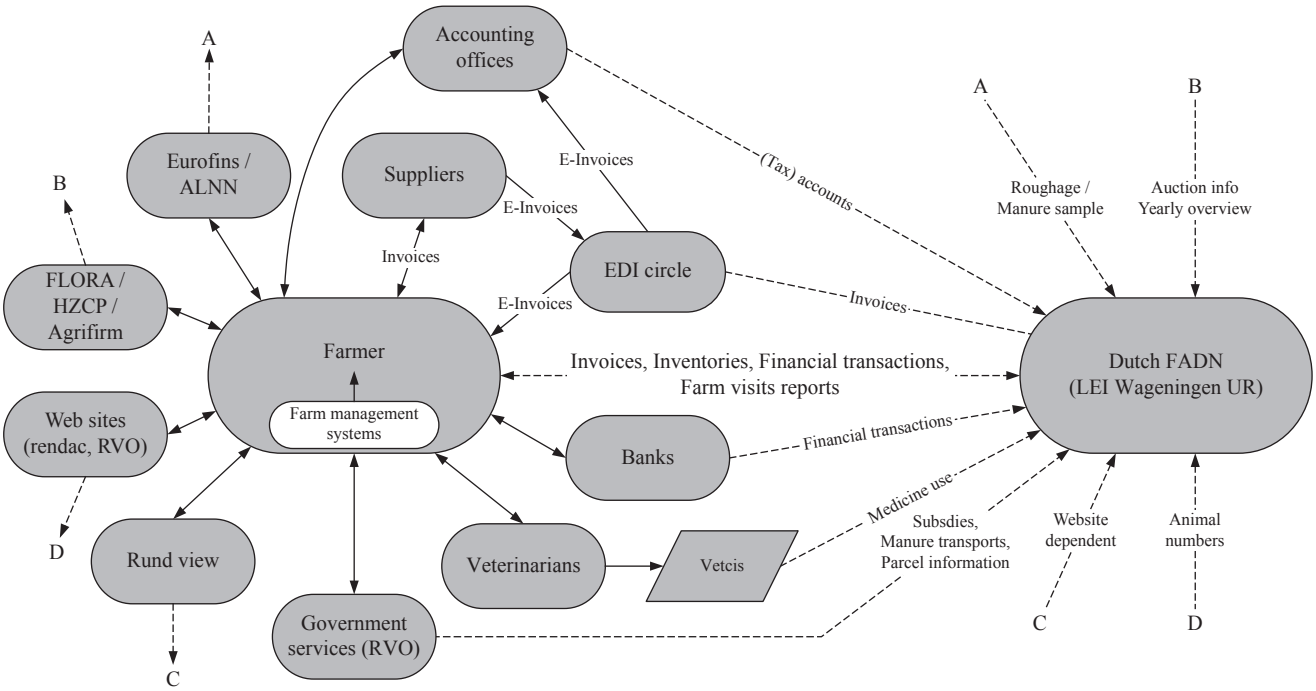

Figure 1: Use of data sources from the network of a farmer to compile accounts (case of the Netherlands).
Source: Vrolijk and Poppe (2016)

This is still the common way of working in most countries. There is however an increasing amount of information that could be collected from other sources. A farmer operates in a network of private businesses of suppliers, traders, processors, banks, insurance companies, auctions and so on, but also of government institutions such as tax office, ministry, paying agency and statistical office. In many cases there is an information flow and information exchange between these organisations and the farmer. This information flow can be verbal, on paper or in an electronic (data exchange) format.

These information flows contain a broad range of relevant information for the data collector to complete the accounts of a specific farm. Re-using this information provides a few potential benefits. The most obvious one is the reduction of the administrative burden on a farmer. All information which can be gathered from an existing source does not have to be collected or asked from the farmer. Re-using information flows also allows the collection of a wider set of data. Invoices, for example, not only contain financial information but also relevant information on, for example, N, P and K mineral content in artificial fertilisers or the types of pesticides bought by the farmer. Furthermore, re-using data provides better opportunities to 'ground truth' the information; it allows easier checking of completeness and consistency between financial and material flows.

More and more countries are experimenting with the use of other sources of information, especially administrative sources such as the subsidy payments or animal numbers. A survey conducted by the FLINT project shows that 70 per cent of the members of the Committee for the FADN make use of administrative sources for the compilation of FADN. Bottlenecks experienced are legal restrictions in combining data sources and the identification of the (same) farm in different systems. The Netherlands is one of the few countries with a more extensive re-use of data from not only administrative but also from commercial information flows (ECA, 2016; Hill *et al*., 2016). The farmer interacts with all kinds of private and governmental organisations and for the compilation of the farm accounts the data collector uses information from these information flows (Figure 1). Access to these information flows is dependent on the explicit permission of the farmer.

The information flows used in the current FADN data collection system affect the possibilities to adopt changes in the data collection processes. Besides the data collection processes, the organisational structure also has an influence on the flexibility.

A typology of organisational structures of FADN in Europe

The organisational structure of FADN differs strongly between EU Member States. In describing the functioning of an FADN system a number of roles at national level should be distinguished, namely the client, the liaison agency and the data collection. These various roles can be conducted by one organisation or can be placed in different organisations. In all countries the client is the responsible ministry, in most cases the Ministry of Agriculture. The ministry has the formal obligation to comply with the *acquis communitaire*, of which FADN is an integral part. The ministry can be the liaison agency, or a governmental or private organisation (i.e. a research institute) can be appointed to fulfil FADN obligations and to coordinate data collection. The personnel of the liaison agency can collect the data or the data collection can be delegated to another organisation (i.e. accounting office or advisory service). Furthermore, there are some supporting tasks which can be outsourced (for example, IT support by a software company, or statistical support by a national statistical office). Different organisational combinations of data collection and liaison agency can be observed in one or more EU Member States (Table 3). Several countries use more than one organisation in the data collection.

Poppe (1997, 2002) defined a typology of FADN systems labelled type Y and type X (Table 4). A crucial distinction between the types is whether the information collection is primarily dedicated to the FADN task or that existing (accounting data) is re-used to fulfil FADN data needs.

In type Y, FADN data collection is done by the FADN liaison agency. Staff of the liaison agency collect the data for FADN purposes. Data collection for the primary purpose at hand, in this case FADN, is defined as primary data collection (Green *et al*., 1988). The data collection is fully dedicated to FADN. This makes it a relatively expensive way to collect FADN data because the whole system is set up and maintained for fulfilling FADN requirements. A major advantage is that it is more flexible to adapt to new information needs. It is easier to instruct and adapt the working flow of own staff to collect additional data elements. This makes it much more cost-efficient to make changes in the data collection. It is a

Table 3: Organisational settings of FADN in Europe (liaison agency and data collection).

Liaison Agency	Data collection		
	Accounting offices	**Advisory service**	**Own liaison agency staff**
Ministry	Spain, Slovenia, France, Estonia, Czech Republic, Belgium, UK, Portugal	Estonia, Romania	Luxemburg, UK, Estonia, Cyprus, Bulgaria, Malta, Portugal, Greece, Belgium
Research institute	Finland, Austria, The Netherlands, Germany, Hungary	Latvia, Finland, Italy, Lithuania, Slovakia, Poland	Ireland, Slovakia, The Netherlands,
Statistical office	Denmark	Sweden	Sweden
Advisory service		Croatia	

Source: own compilation

Table 4: Typology of FADN systems in Europe.

	Type Y	**Type X**
Primary/secondary	Primary data collection	Secondary data collection
Data collected by	own staff	buying from accounting office
Fixed costs	High	Low
Marginal costs	Low	High
Information feedback to farmers	High	Low
Interest by farmers	High	Low
Data use by research	Often (critical success factor)	Incidentally

Source: based on Poppe (2002)

system with relatively high fixed and low marginal costs for data collection. Within this type, still two common groups can be distinguished. In some countries the data collection is done by farm advisors who divide their time between data collection and advisory tasks. In the second group data collection is done by specialised data collectors.

In type X, data are provided by (fiscal) accountants. The data used to compile the farm accounts are re-used from tax accounts. There is still some additional work needed to make the fiscal accounts suitable for FADN purposes (mainly on the valuation and depreciation of assets) but in general it is relatively cheap because the cost of bookkeeping is already covered by farmers. The farmer pays for the service of the accounting office to keep (tax) accounts. Only the additional work is accounted for in the FADN budget. Although type X is therefore relatively cheap, at the same time it is more difficult to make changes in the data collection. Accountants have their own way of working to compile the tax accounts and it is more difficult to adapt their working procedures for just a small group of clients who participate in FADN. Such a system has relatively lower fixed costs but a high marginal cost and much resistance to additional data.

Type Y or X strongly determine the flexibility of the data collection and therefore the opportunities and limitations for collecting sustainability in the scope of FADN.

Collecting sustainability data in the different types of FADN

The flexibility to adapt the data collection differs strongly between the types of FADN systems in Europe. In the types where liaison agency personnel are responsible for the FADN data collection, changing information needs can be adopted in the data collection system. Collecting new variables can be fully implemented within the own organisation. It requires the definition of the new variables, instructions for data collectors, training of data collectors, adaptation of the IT system to record and process the new data and if useful, an extension of the feedback report to farmers.

An important element in collecting new variables is the analysis how to collect good quality data at the right moment in time. For quality reasons, systematic recording is strongly preferred in comparison to the use of farmer recollection. As previously mentioned, the farmer interacts in a network of different private organisations and governmental institutes, with different types of information exchange. For the new data elements an evaluation should be made as to which potential sources exist and under which conditions they can be used (legal restrictions or privacy regulations), and what the practical challenges are (identification of farms in different systems, format of data availability etc.). For efficiency reasons it is easiest to get access to the data of all relevant farms directly from the source, but if this is not possible the data can sometimes be obtained from the farmer side of the information exchange (e.g. subsidy payments for all farmers from the paying agency vs. use of a notification of the paying agency to an individual farmer about the eligible subsidies). The work flow should be designed to facilitate the chosen option.

In practice, the same could be applied when data collection is outsourced but, as this requires a change of work flows of an external organisation (accounting office) for whom FADN is not the primary business activity, this will be much more difficult to achieve. Owing to the EU law, these accounting offices are selected based on a tender procedure and contracted for one or several years. It is less obvious for accounting offices to redesign their primary working processes for the sake of FADN. A private accounting office needs a clear business model to make these changes, or by getting a fair compensation from the FADN budget or with a business model of collecting these data for their normal clients, the farmers. An example of the latter is the compilation of mineral accounts/balances if there is a legal obligation or farming need to establish these accounts (Breembroek *et al*., 1996). In that case, farmers are willing to pay and accounting offices are often willing to compile them.

If it is not or only partly possible to get the new data elements from the accounting offices, alternative strategies should be implemented. One option is the use of staff of other organisations to collect the data elements which cannot be provided by the accounting office. Given the advantages described above, preferably this additional data collection is at least partly based on the same supporting documents as used in the normal accounting workflow, in order not to fall back immediately on the least preferred option of farmer recollection.

In the FLINT project, different examples of data collection processes and different organisational systems were represented among the project partners. How the data collection was designed in the different countries and what the experiences are with this data collection is described next.

Sustainability data collection in FLINT

The farm-level indicators were selected using a three stage process: identification of existing policy needs, review of current literature and feedback from different stakeholders. Altogether 33 different indicator topics were identified. These 33 topics were defined at a higher level (e.g. innovation or N balance) and could not be measured directly at farm level. Therefore, for each of the 33 topics an exact specification was made regarding which variables to collect. A document was prepared with definitions of each of the variables. In line with the FADN Farm Return, this document was called the FLINT Farm Return. For practical reasons the required data were rearranged into ten tables and structured and described according to FADN standards. This way the data collection could be better integrated in the national FADN systems and more importantly it allowed the use of the current data checking infrastructure (RICA-1) of the EC to check the FLINT data. FLINT data were crosschecked with FADN data at farm level to enhance data quality.

In the FLINT Farm Return about 1,060 new variables were defined. Not all variables are relevant on a specific farm (a farm only has a selection of crops or animal categories), so on average 300 to 400 data items were collected at farm level in addition to the existing FADN dataset. The feasibility of data collection was tested in nine countries with a

Table 5: Methods of data collection in the FLINT project by EU Member State.

Member State	Number of farms		Integration with FADN	Data collected by	Method of data collection
	Selection plan	Data collected			
Type 1: own staff data collection					
Greece	110	124	Separate	FADN data collectors	Farm visit
Ireland	65	64	Integrated	FADN data collectors	Farm visit
The Netherlands	150	155	Integrated	FADN Data collectors	Other sources and farm visit
Poland	140	146	Integrated	FADN data collectors (farm advisors)	Farm visit and other sources
Spain	165	165	Separate	FADN Advisors and FADN accounting office	Farm visit and other sources
Type 2: Outsourced data collection					
Type 2a: Ministry supervision					
France	150	297	Separate	Students	Farm visit
Germany	95	52	Separate	Researchers	Postal questionnaire
Type 2b: Research institute supervision					
Finland	50	49	Integrated	FADN accounting office	Farm visit
Hungary	100	102	Integrated	FADN accounting office	Farm visit

Source: own compilation

wide range of data collection processes and FADN systems. For some countries the FLINT data collection was integrated with the regular FADN data collection process, in others the FLINT data were collected in a separate process (Table 5). The objective was to collect data on 1,000 farms during the pilot phase. A selection plan was designed to decide how many farms in each farming type and in which size classes should be included in the FLINT sample.

The participating countries generally achieved the number of farms to be collected. The only exception was Germany where legal restrictions made it more difficult to get access to the contact information of FADN farmers. This made recruiting farms a much more difficult process, which resulted in fewer participating farmers.

During and after the data collection, the experiences with the data collection were monitored. The experiences were brought together in a FLINT online questionnaire. The results are summarised in four parameters, (a) *Feasibility*: whether data can be collected according to the given structure, (b) *Complexity*: ability to cope with complexity (c) *Availability*: the extent to which data are collectable on the farm or from other administrative sources, and (d) *Data quality*: the reliability of collected data. These items were scored on a five point Likert scale, ranging from poor to excellent, and the scale was assumed to be ratio-scaled.

To analyse the impact of different organisational settings with respect to data collection the categories adopted in Table 5 were used. A distinction was made between 'own staff data collection' (type 1) and 'outsourced data collection' (type 2). This latter category had the sub types 'ministry supervision' (type 2a) and 'research institute supervision' (type 2b). A comparison between type 1 and type 2 only showed very minor differences. This implies that FLINT data collection can be achieved in both FADN environments, irrespective whether data are collected by own staff or outsourced to a third party. However, within the 'outsourced data collection' a substantial difference was observed between type 2a and type 2b (Figure 2). Ministry supervision scored lower on feasibility, data availability and data quality, while the ability to deal with the complexity showed a smaller difference.

In interpreting this finding it is important to note that the countries belonging to 'ministry supervision' belong to Type X of the Poppe typology. FADN data are bought from

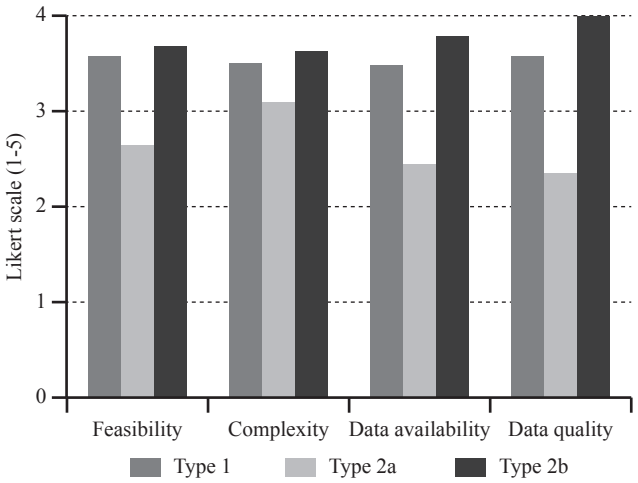

Figure 2: FLINT data collection experiences in different organisational settings.

For definitions of data collection types, see Table 5
Source: own data

accounting offices, there is not a very strong link between the FADN system and the individual farmer, and farmers do not get much feedback from the FADN system. Owing to national circumstances, FLINT data had to be collected in a separate process. In this setup no use could be made of the strong link between data collector and farmers which was perceived to be very important in other countries.

Discussion and conclusions

An increasing need for sustainability data has led to the question how to make these data available for policy making. This paper explores the opportunities to collect sustainability data in the scope of FADN. The pilot project in nine countries including 1,000 farms has shown that in general it is feasible to collect this type of data. The findings show that sustainability data can be collected independently of whether the data collected are collected by own staff or the task is outsourced to a third party. What does make a difference is the relationship between the farmer and the FADN system and especially the FADN data collectors. The built-up trust is

an important factor in the willingness of farmers to share the FADN data but also the additional FLINT data.

Using FADN to collect sustainability data further provides the opportunity to make use of the existing quality mechanisms. This does not only concern the quality of the collected data but also the quality of the processes (Ehling and Körner, 2007). The collection of sustainability data would benefit from existing quality processes ranging from the definition of the selection plan and the evaluation of the sample to work flows, instructions and training sessions for data collectors. The quality can also benefit through the strong linkage between the collection of environmental and social data in combination with the economic data.

Collecting more data does increase the complexity of data collection. The step from collecting economic data to sustainability data might seem substantial, but analysing the impacts reveals that the main step is from systematically recording the financial economic aspect of the flows going in and out of the farms to also recording the relevant physical/material aspects of these same flows. Often the same source documents can be used. If a farmer buys pesticides, fertilisers, petrol etc., the data collector / accountant records the financial amounts from the invoice. On the same invoice there is (in most cases) also information on the physical flows, such as quantity and product name of pesticides, quantity and N, P and K content of fertilisers, quantity and type of energy source etc. If a data collector is clearly instructed to not only record the financial amounts but also the important physical attributes on the same invoice, a major step has been made in collecting the data needed to calculate indicators of the environmental aspects of sustainability performance (e.g. use of active substances of pesticides, N balance at farm gate, greenhouse gas emissions etc.).

Utilising this connection between financial and physical flows provides big advantages for the quality of the collected data, the completeness of the collected data and the burden on farmers. The quality can be enhanced by the opportunities of cross-checking financial and physical flows. The completeness is better assured because the information is based on systematic recording and less emphasis is put on farmer recollection. Ssekiboobo and Zake (2016) show that direct estimations from farmers over (or under) estimate variables such as production when compared to the results of a systematic recording. The administrative burden of farmers can be reduced because the information which can be collected from invoices or other documents does not have to be requested from the farmer.

There are also some statistical aspects in extending FADN to other sustainability issues. FADN is often claimed to be designed to be representative for economic issues (Oenema *et al*., 2011; Koester and Loy, 2016). Although this claim is often not made more precise, a few aspects should be distinguished. These are the demarcation of the field of observation and the sample design of FADN. With respect to the demarcation of the field of survey, FADN is aimed at covering commercial farms, namely those that produce for the market and are larger than a certain minimum economic size (EU, 2010). This threshold differs between countries to reflect the different agricultural structures and different economic situations in countries.

Farms smaller than the threshold are not included in FADN but do have an impact on the environment and the social dimensions of rural areas, especially in those regions with a large number of small and/or semi-subsistence farms (Tocco *et al*., 2014; Tudor, 2015). Here it is important to be aware of the fact that FADN is designed as a tool to monitor and evaluate the EU's Common Agricultural Policy (CAP), which is mainly targeted at and affects commercial farms. Collecting sustainability data on FADN farms does not provide data on very small farms, but does provide the opportunity to evaluate the impacts of the CAP on economic, social and environmental objectives. If the CAP would be focused on smaller farms, changing the field of observation of FADN should be considered, irrespective whether sustainability data are collected or not.

The FADN sample is stratified based on two dimensions, economic size and type of farming. Both dimensions are based on the concept of Standard Output (SO) which is a standardised measure for the expected output of a farm based on the agricultural activities on the farm. The sample allocation (how many farms to include in each strata) is based on different allocation methods, such as proportional or optimal allocation (Vrolijk, 2002). Although SO is defined as an economic indicator to be able to sum different agricultural activities to establish the size of the farm, the practical impact of this choice is very limited. Also for collecting data on environmental and social issues, type of farming and size of farming would be important stratification variables. Owing to the very strong correlation between physical size and economic size (especially within a type of farming) the resulting sample structure is likely to be very similar. What could be different is the exact allocation of the sample size to the different strata. When applying proportional allocation the result would be the same. With optimal allocation, the sample size within each stratum can differ based on the choice of the variable to define the homogeneity of farms in a stratum.

In case sustainability data would be collected in a separate environmental network, the quality of environmental estimates would improve in terms of a reduced variance of the estimates, because the sample can be designed to minimise this variance for the specific environmental variable. A major disadvantage of a separate environmental network is the loss of a direct link with policy measures. Policy measures do not directly affect the environment. Policy measures affect decision makers (in this case farmers), and the behaviour and the change in behaviour of farmers can lead to different farm management decisions and farming practices and these affect the environment. To understand and evaluate the impact of policy measures it is therefore necessary to understand the structure and the farm practices of individual farms. These farm structures and farm practices are recorded in the current FADN.

Although the nine countries included in the FLINT project cover the different types of FADN systems in Europe, the collection of sustainability data in all 28 Member States still poses some challenges. The extension of data collection is dependent on the political support in countries. This requires a trade-off between the financial costs and the burden on farmers on one side and the value of the collected data on the

other side. A complicating factor is that policy makers are very concerned with the burden on farmers in their country while the added value of the data for policy making is to a large extent at the European level. Extending the system means that more countries, more farmers and more data collectors will be involved. This will require proper incentives for all those stakeholders affected. Incentives are not limited to financial incentives but can also exist through added value from the collected data.

To balance the workload of farmers it is important to intensify the use of existing data in all countries and not only in those who have already made progress in this. Best practices and experiences in collecting data from existing administrative and commercial information flows should be shared. This makes the data collection more cost-efficient, increases the data quality and assures a better alignment between information needs from different stakeholders.

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