Costs and benefits of collecting farm data for the new CAP's data needs: empirical evidence

Hans C.J. Vrolijk and Krijn J. Poppe

Wageningen University and Research, The Netherlands

hans.vrolijk@wur.nl; krijn.poppe@wur.nl

Paper prepared for presentation at the 172nd EAAE Seminar
'Agricultural policy for the environment or environmental policy for agriculture?'

May 28-29, 2019.

Brussels.

Abstract

The Common Agricultural Policy post 2020 will address an increasing set of objectives, including contributing to the sustainable development goals and the Paris climate agreement. Current monitoring systems are focussed on structural and economic data and hardly cover performance indicators on the sustainability performance of farms. The EU financed FLINT project demonstrated that it is feasible to collect these sustainability data at farm level and illustrated the added value of having this type of data in a range of case studies. In this paper the costs and benefits of collecting sustainability indicators are described. Collecting the sustainability data on all farms included in FADN would increase the costs with about 40%. Large differences between countries can be observed depending on the current costs of data collection and the expected additional work to include sustainability indicators. Given the pressing need for these data a scenario is developed where sustainability data is collected on a sub-sample of 15.000 farms. This can be achieved within current budget limits if the current FADN sample would be reduced from 85 to 75 thousand farms.

Keywords: Data collection, Sustainability, Data needs, Cost and benefits

Introduction

The CAP post 2020 will show a higher level of ambition to mitigate environmental and climate impacts. The policy is set to shift the emphasis from compliance and rules towards results and performance. The shift to more environmental policies, the interplay between environmental and agricultural policies and the shift to results and performances will bring forward new data needs for monitoring and policy evaluation. Changing data needs are not entirely new (Abitabile et al., 1999; ECA, 2003; Poppe, 1997), but the needs are more compelling, given the growing emphasis on environmental and climate impacts.

In reaction to these needs, several indicator frameworks have been developed by a range of international organisations (such as United Nations millennium development goals, Eurostat agri-environmental indicators, European Environment Agency indicators, OECD agri-environmental indicators, FAO indicators of sustainable development). In addition several research projects have developed indicator sets (IRENA, AE Foodprint). Also at national level there are initiatives to collect data to measure the sustainability performance of farms (Dillon et al., 2010; Boone and Dolman, 2010; Platteau et al., 2014). Overlooking these initiatives, the conclusion can be drawn that initiatives differ in level of measurement (farm, regional or national level), empirical implementation (some frameworks exist on paper but it is unclear how data should be collected) or are not harmonised across countries. Due to these issues there is not a clear strategy how to meet the information needs on the sustainability performance at farm level for the EU as a whole.

To address these needs the FLINT[1] (Farm Level Indicators for New Topics in policy evaluation) project was created to test the feasibility of collecting sustainability data at farm level and to illustrate the value of this type of data to improve policy making. The project has defined a list of relevant sustainability themes based on emerging policy needs, a literature review and a review of national initiatives to measure sustainability (Latruffe et al, 2016a). The themes have been discussed with different stakeholder to evaluate the feasibility and usefulness of collecting farm level data on these themes (Hererra et al., 2016). Finally 31 themes were selected (see figure 1), which have been translated into a list of data items to be collected at farm level.

[1] See https://www.flint-fp7.eu/ for the official project website with all project documents.

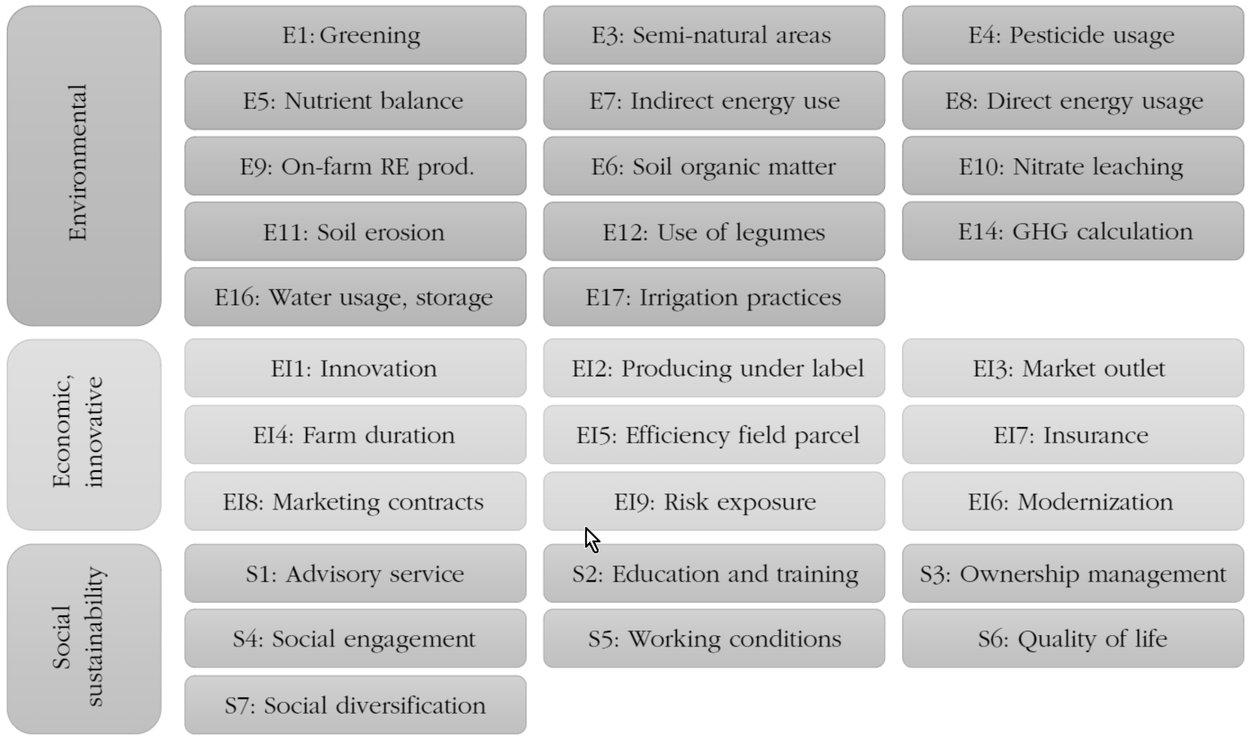

Figure 1: Sustainability themes as included in the FLINT data collection

The feasibility of collecting these data was tested by collecting the defined data items in 9 member states (Ireland, Netherlands, Germany, Poland, Finland, Hungary, Greece, Spain and France) on 1,100 farms of different farm types (Vrolijk et al., 2016). The results show that data collection is possible in the different administrative environments that member states face or have chosen to organize the national FADN. In general, the FLINT project showed positive experiences of collecting sustainability data, furthermore the project showed that farmers are willing to make the data available (Poppe and Vrolijk, 2017).

The project has shown how policy analysis benefit from additional data with indicators on the sustainability performance of farms (profit, planet and people aspects). A number of cases was selected to illustrate different aspects of these new opportunities (i.e. comparison of sustainability performance between countries, trade-off between different sustainability indicators and the link between specific policy measures and the broader sustainability performance of farms).

Buckley et al. (2017) illustrated how this type of data facilitates a comparison between countries. Nationally representative nitrogen use efficiency indicators for specialist dairy farms in the Republic of Ireland and the Netherlands were established. Results indicate relatively similar N balances per hectare across both countries with the Netherlands returning significantly higher N use efficiency and lower N surplus per kg of milk solids produced.

Latruffe et al. (2016b) assessed the trade-offs between economic, environmental and social sustainability using a variety of indicators. Results indicate that there are trade-offs between economic sustainability and environmental sustainability, as well as within environmental sustainability (depending on the indicators). Farm level analysis also revealed differences in the sense that indicators are positively correlated for some farm types and negatively for others.

Asseldonk et al. (2016) analysed the role of the government in risk management of farmers. Given the increased attention to risk management in the Common Agricultural Policy, it is important to monitor and evaluate the adoption rates and their determinants over time. The analysis confirms that adoption rates of risk management instruments such as insurance contracts, price contracts, off-farm income, other risk reduction measures and other gainful activities vary significantly across EU member states and farming types. Econometric analysis indicates that larger farms adopted more often crop insurance, occupational accident insurance, price contracts and diversification but were less likely to adopt credit avoidance and off-farm employment (at a significance level of 1%).

Brennan et al. (2016) describe the aging farming population and the impact on sustainability. The data suggests a significant relationship between indicators of economic, environmental and social sustainability and the age of the farmer. For each additional year of farmer age, declines can be seen in output per hectare, gross margin per hectare, family farm income and farm viability. As the farmer ages, declines can be seen in environmental impacts as well.

The last example is the impact of advisory services on the sustainability performance. Results (Brennan et al., 2016) indicate that the extent to which households engage with extension services has implications for the sustainability at farm-level. Participation in extension programs has a positive impact on economic indicators. The environmental indicators suggest that those who participate in extension programs have the poorest performance in terms of greenhouse gas emissions and risk of loss of nutrients to water (nitrogen per ha), though this result is statistically insignificant.

These and other cases (Meulen et al., 2016; Herrera et al., 2019; Tzouramani et al., 2017) based on the FLINT data illustrate the value of sustainability data for research and policy evaluation. Given these conclusions the ultimate question is whether this pilot should be prolonged and extended to all EU member states. Obviously this heavily depends on the costs and benefits of collecting sustainability data at farm level. Until now little information is available on the costs and benefits of collecting data on the sustainability performance of farms as the FLINT project is the first serious attempt to collect these data in a harmonised way in a number of member states. The experiences of the FLINT project allows an assessment of the costs and benefits of data collection.

This paper therefore addresses the costs and benefits of collecting farm data for the new CAP's needs. Empirical evidence from the project is used to describe and quantify the costs and benefits of farm level data for the new CAP data needs.

Data and Methods

The first data source used in this paper is a survey among data collectors in the pilot countries. During the FLINT project the data collection was monitored to assess the feasibility of the data collection and the costs and time requirements. One of the questions asked to data collectors was how much time they spent to complete the data collection on one farm.

The FLINT project was a pilot conducted in 9 countries. To be able to draw conclusions for the EU-28, information on the non-pilot countries was used. A survey was conducted among FADN managers from all EU member states. The survey aimed to collect data on the organizational setup of the data collection, the scope of the current data collection and the time requirements to collect the current FADN data. All member states responded to the survey. In addition, the results of a study commissioned by the EU Commission on the costs of FADN (Bradley and Hill, 2015) were used to extrapolate the costs of the pilot countries to all EU member states.

In the extrapolation, it was acknowledged that the increase in costs differ strongly depending on the current processes and costs of data collection. This varies widely due to the different administrative environments, some countries have dedicated staff to collect FADN data, in other countries the data is purchased from accounting offices. The existing data collection processes affect the complexity to collect the new data items. A typology of organizational systems was used to categorize countries.

Results on costs and benefits

Benefits of data collection

Quantifying the benefits of better data for policy making faces the same issues as quantifying the benefits of the use of current monitoring data, such as FADN. Bradley and Hill (2015) describe that the benefit from information coming from systems like EU-FADN and national farm accounts surveys is dependent on the impact it makes on decisions by users compared to the outcomes that would occur without it. If this information is unused or ignored, there is no benefit. It follows that key to detecting the presence of benefits flowing from FADN data is the identification of the usage of these data.

They (Bradley and Hill, 2015) further conclude that the benefits are difficult to quantify in monetary terms. The benefits consist of private benefits (data can be used by farmers to improve performance through for example benchmarking) and public benefits (better policy decisions lead in the end too better outcomes).

The private benefits of FLINT data can be found in improved decision making at farm level. Benchmarking is an effective way to increase the awareness and knowledge of farmers of their performance (see Franks and Collis (2003) for a review of benchmarking). The traditional benchmarking of economic performance needs to be extended to benchmarking of the wider sustainability performance (EIP, 2016). The lessons learned from benchmarking activities provide useful information to improve the sustainability performance at farm level. Bouters (2010) and Woodend (2011) illustrate how farmers appreciate the information from FADN and how it influences their decision making. Due to project limitations the benefits for individual farmers could not be empirically tested during the FLINT project.

The public benefits were addressed during the FLINT project. The benefits for policy making were illustrated by a number of cases. The analysis were used to illustrate how the additional data provides benefits in terms of (1) filling gaps in terms of research methodology (i.e. social performance, economic viability); (2) provide better understanding of the sources of sustainability performance (i.e. impact of land fragmentation, advisory services, age of assets); (3) provide additional insights in challenges faced by farmers (i.e. trade-offs between environmental and economic performance) and (4) provide more precise recommendations for policy makers (i.e effect of CAP subsidies on technical efficiency; impact of investment subsidies on age of assets).

Although difficult to quantify, the results of the project facilitate the pursuit of societal goals in particular environmental and those related to rural development by improving the targeting, efficacy and efficiency of agricultural policies (Poppe and Vrolijk, 2017). The project has demonstrated the increase in public value of the FADN data set when data on the sustainability performance of farms is included. Collecting, managing and processing of farm level data in the FADN requires large financial resources. Societal benefits come from policy applications (Plees, 2015; Defra, 2014; Hradisky, 2013) and research applications (see for example Kimura et al. 2010 and Kimura and Chi, 2013). An increase in the use of the data by aligning it to the new policy objectives increases the benefits and provides a stronger justification for these expenditures.

Costs of data collection

Adding the FLINT data to the FADN obviously adds a cost. Estimating these costs is not a trivial issue. Estimating the costs of the existing FADN system in Europe is already a challenge. Bradley and Hill (2015) made an inventory of these costs. We will describe the estimation of the costs of the FLINT data collection in two steps. The first step consisted of an estimation of the costs in the pilot countries involved in the FLINT project, in the second step we made an estimation of the costs for all member states.

Collecting FLINT data in national farm accounts surveys will require adjustments in the systems. While we conclude that the costs of adaptation will be specific to each Member State, some general principles are evident. Although extending the collection of any type of data to the member states that do not currently collect it would incur costs, these would be marginal to the basic data collection infrastructure already in place.

Estimation of costs for the FLINT pilot countries

During FLINT data collection, consortium partners had to face initial costs (such as training of data collectors, developing and installing IT infrastructure, etc.), which occur only in the first year and will incorporate into general FADN data collection costs if the European Commission decides to turn the pilot network to an operational EU-wide system. To determine the additional cost of FLINT data collection, consortium partners and data collectors were asked to provide input in an online questionnaire. The survey covered the time required for the data collection by type of farming, the incentive scheme used to gain the data from the farmers and a cost estimation.

Based on the responses there was no special incentive in eight out of nine member states to persuade the farmers to take part in the FLINT project. Where data collection was made by FADN data collectors (Finland, Netherland, Hungary, Spain) the good relation between data collectors and farmers encouraged participation. Farmers were informed about the aim of the data collection. Only German farms did receive a financial incentive (150-500 euros per farm) as compensation for the time and effort needed to participate in the FLINT survey.

The data collectors gave an estimation of the time required for collecting the data per farm, which contains detailed information on time needed for preparatory work, farm visit, completion, delivery and control of the data (see figure 2).

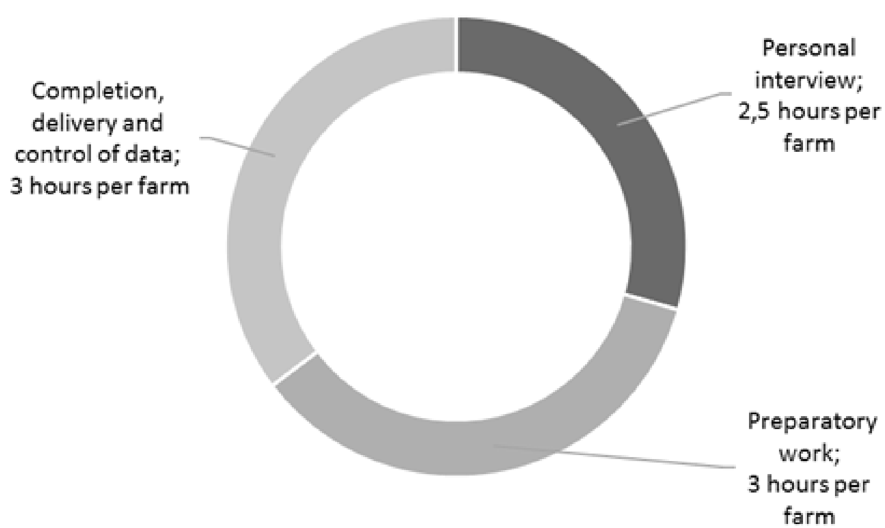

Figure 2: Time required for data collection per farm

Source: Online survey of data collectors

Looking in more detail, a substantial variation among member states concerning the time needed to collect the data can be observed. The results are influenced by the applied data collection methodology, the extent to which FLINT data was already part of the national FADN systems, the number of FLINT indicator themes relevant in the country, as well as the type and the size of a given farm. The average time required for data collection and data processing (including validation) is almost nine hours which vary from five to fifteen hours depending on the above mentioned circumstances.

Despite the fact that FLINT data collection was based on the FADN data collection methodology, the whole data collection procedure had to be established from the beginning. A new farm return was implemented, data collectors had to be trained and new or adapted IT infrastructure was installed for data recording, validation and storage. In case of those member states (Ireland, Finland, Netherlands, Hungary, Poland), where the FADN data collection is flexible and the system can easily adopt changes, the initial set-up costs were relatively low and existing resources were more effectively used. Initial costs, which incur only in the first year, distort the estimation of cost of data collection.

The total expenditure of data collection is not directly comparable between member states. In Germany the farmers self-reported their data and they received 150-500 euros per farm, but the data recording into the official FLINT spreadsheet was made by researchers. Poland spent 100 euros per completed questionnaire, but this figure does not contain the cost of data entry. In Spain, Hungary and Finland on average 300 euros per Farm Return were paid for the data collection (the cost of recording included). The other additional costs, such as recruiting of farms, training of data collectors, validation of data, application of new IT solutions vary from member state to member state, depending on the administrative environment and existing infrastructure in which FLINT data collection was integrated.

Estimation of costs for all EU member states

To estimate the costs of collecting FLINT data in all member states a survey was distributed among all member states. The survey asked for the hours and budget per FADN farm and an estimate of the required number of hours to collect the FLINT data. In order to cross check the data and to be able to impute a value in case of missing values, countries were categorised in three types (column 2). Column 3 gives the number of hours per FADN farm (if the data was missing in the FLINT survey an estimate was made based on the Bradley and Hill report). Column 4 gives the costs for collecting data on one FADN farm (labour costs and in some cases costs for 'buying' the data from accounting offices, missing values based on Bradley and Hill). The hours per farm to collect the FLINT data (column 5) are the indications by the FADN committee members for their country. Missing values were imputed by the average of hours (column 5) belonging to the same type (column 2). Also outliers were corrected by the research team. Based on these assumptions the costs for adding the FLINT sustainability data were calculated.

Table 1: Costs of FADN and FLINT data collection in Europe (euros per farm)

Country (1)	*Type (2) **	*Hours per FADN farm (3)*	*Data collection cost per hour (4)*	*Hours per farm for FLINT data (5)*	*Current costs FADN farm (6)*	*Estimated costs FADN farm + FLINT data*	
						In Euros (7)	Increase % (8)
Austria	2	16.8	46	10	1,360	1,819	34%
Belgium	2	56	36	12	2,000	2,429	21%
Bulgaria	2	15	14	10	209	348	67%
Croatia	2	15	9	10	130	217	67%
Cyprus	3	7	36	8	250	536	114%
Czech Rep.	2	30	12	9	370	481	30%
Denmark	1	6	60	5	400	699	75%
Estonia	2	28.8	14	9	314	439	40%
Finland	2	25	40	7	1,000	1,280	28%

France	3	4	52	12	500	1,119	124%
Germany	3	8	46	12	600	1,157	93%
Greece	3	24	53	12	1,273	1,910	50%
Hungary	2	6	11	6	500	566	13%
Ireland	1	24	42	2.5	1,000	1,104	10%
Italia	1	15	20	8	300	460	53%
Latvia	3	12	23	12	270	540	100%
Lithuania	2	8	31	5	250	406	62%
Luxembourg	2	50	40	15	2,000	2,600	30%
Malta	2	4	25	9	100	325	225%
Netherlands	1	54	56	6	3,000	3,333	11%
Poland	2	32.2	20	10	656	860	31%
Portugal	2	37.5	13	9	500	620	24%
Romania	3	4	7	12	100	179	79%
Slovakia	2	20	17	10	340	510	50%
Slovenia	3	15	23	12	263	542	106%
Spain	3	10	32	6	500	691	38%
Sweden	2	9	56	12	800	1477	85%
UK	2	44	45	9	2,000	2,409	20%

* (1) Netherlands/Ireland: already much data available, FLINT data gathered in same process as FADN; (2) Poland/Hungary: not much data available, FLINT data gathered in same process as FADN and (3) France/Greece: not much data available, FLINT data gathered in a separate farm visit.

The results reflect a range of local circumstances. Based on their inventory, Bradley and Hill conclude that the amounts differ due to differences in wage levels and due to differences in the scope of data collection. However, there are also other factors, such as whether the costs only include direct labour costs or a full commercial rate (including overhead costs and a profit margin); the quality of the data; special costs (e.g. the inclusion of costs of big ICT projects that once every ten or 15 years reorganise the software and working methods); and a potential under sourcing in some countries. The assumption is that these factors also affect the estimation of costs for the collection of FLINT data and that data collection costs per hour and the required number of extra hours provide an acceptable basis for estimating the FLINT data collection costs.

The estimated change in costs as displayed in column 8 in table 1 shows a large range: from countries such as Ireland (+10%) and the Netherlands (+11%) to France (+124%) and Malta (+225%). One part of the explanation is that some of the countries already gather several data items from the FLINT data set for national purposes, but do not yet make them available to the EU FADN. Another is that some of the data-heavy FLINT farm return topics are not relevant in some countries, thus reducing the data collection burden (e.g. hardly any pesticides on crops in the Irish FADN sample where livestock dominates). Another is that countries with relatively low extra costs see options to integrate the data collection in the current process, where others are not able to do so or have to pay the full cost of such an adaption, as the current costs are relatively low as the FADN data are a by-product of tax accounting. This implies that the differences in costs between countries are lower in the desired situation where FADN data are supplemented by FLINT data then in the current situation with only FADN data: the burden is on those with relatively low costs in the current situation.

On average (weighted with the number of farms per member state) the costs of adding the FLINT sustainability data to the FADN imply an increase from 750 euros per holding to 1,040 euros. Adding the FLINT data to the full FADN sample of 85,000 farms would increase the costs by about 40%. Although these additional costs are low compared to the amount of subsidy payments and the pressing need for this information, available public resources are under scrutiny. Therefore the project explored some scenarios to reduce the costs of data collection without comprising the usability and statistical soundness of the results.

Collecting the full set of FLINT sustainability on all FADN farms, without increasing the current budget would lead to a reduction of the FADN sample with a third, from 85,000 to 55,000 farms. Although this would not jeopardize the income estimation at EU level, it would lead to considerable changes of the FADN panel in some countries such as France, Germany and Sweden. Such countries would most likely be confronted with unreliable estimates for some farm types at regional level.

Upscaling the FLINT data collection could better be done to a sample of 15,000 farms for 28 member states (Poppe and Vrolijk, 2018). If that sample would be optimally allocated over the member states and farm types this would guarantee a relative standard error below 3%, and makes it possible to publish results for the most important farm types in the individual member states.

There are two options to start with this sample of 15,000 farms. One option would be a FLINT-2 Policy Research Infrastructure project, with extra funding. The sample allocation of these 15,000 farms should be based on an optimal allocation over the member states and would cost about 4.2 million euros a year in data collection costs. The other option is to include it in the FADN and finance it from the current FADN budget. That would imply a reduction of 10,000 farms, bringing the FADN sample back to 75,000 farms. Also this reduction would be unevenly distributed over the member states. This option would increase the value of FADN by widening the scope of analysis to a range of sustainability themes while maintaining the statistical quality of estimates of important indicators in FADN.

The distribution over the member states of these 15,000 farms is given in Table 2. Combining that with the estimation of cost for data collection in Table 1 gives the reduction needed in the FADN sample to collect this data within the current budget.

Table 2: Number of FADN farms per member state and with FLINT data collection for a subsample in the option FADN subsample (excluding Croatia, for which basis (2013) data were not yet available)

Country	Current FADN sample	Sample for FLINT data	Increase in cost (in %)	Required reduction in FADN	Adjusted FADN sample	% FLINT farms
Belgium	1,228	360	0.06	77	1,151	31%
Bulgaria	2,239	229	0.07	152	2,087	11%
Cyprus	469	23	0.06	26	443	5%
Czech Republic	1,401	274	0.06	82	1,319	21%
Denmark	1,827	421	0.17	314	1,513	28%
Germany	8,880	2,089	0.22	1,939	6,941	30%
Greece	4,777	227	0.02	114	4,663	5%
Spain	8,716	1,907	0.08	729	7,987	24%
Estonia	660	41	0.02	16	644	6%
France	7,552	1,946	0.32	2,409	5,143	38%
Hungary	1,972	380	0.03	50	1,922	20%
Ireland	938	150	0.02	16	922	16%
Italy	10,929	3,342	0.16	1,782	9,147	37%
Lithuania	1,067	50	0.03	31	1,036	5%

Luxemburg	444	9	0.01	3	441	2%
Latvia	998	43	0.04	43	955	5%
Malta	507	3	0.01	8	499	1%
Netherlands	1,513	899	0.07	100	1,413	64%
Austria	2,119	161	0.03	54	2,065	8%
Poland	12,321	718	0.02	223	12,098	6%
Portugal	2,285	192	0.02	46	2,239	9%
Rumania	5,881	430	0.06	340	5,541	8%
Finland	846	106	0.04	30	816	13%
Sweden	1,070	216	0.17	182	888	24%
Slovakia	563	150	0.13	75	488	31%
Slovenia	944	48	0.05	50	894	5%
UK	2,805	588	0.04	120	2,685	22%
Total EU	84,951	15,000		9,011	75,940	20%

The calculations show that collecting the FLINT sustainability data on 15,000 farms would demand a reduction of less than 10,000 FADN farms, bringing the sample down from 85,000 to 75,000 farms. At EU level that is not a big loss in precision of the income estimators. The FLINT sustainability data would then be gathered on 20% of the farms.

Discussion

The benefits could be further increased by aligning the information needs of policy makers and those of the sector. Several industry schemes oblige farmers to collect sustainability data. The harmonisation between industry indicators and those used in FADN and policy evaluation would be beneficial. Farmers will make data more easily available if data is already in their management software for the industry schemes. It reduces administrative burdens if farmers can supply the same data to the FADN as to industry.

Looking to the future, there are opportunities for further integration of sector and policy initiatives. The FLINT project objective is to provide quantitative information that helps policy makers to make decisions or to evaluate the impact of decisions for a country or farm type. There are many initiatives that measure sustainability performance in agricultural systems. The goal of the initiative determines what data should be assembled and which tools and indicators could be used to measure processes and practices. Despite the differences in goal and scope, there are opportunities for harmonisation and alignment between measurement frameworks, tools, and data assembling systems. At product level, for example, The Sustainability Consortium (TSC) (TSC, 2017) convenes stakeholders in consumer good supply chains and develops science-based key performance indicators (KPI) that measure environmental and societal performance per product category based on a life cycle approach. Quantifying KPIs often requires farm-level data or regional estimates from a sub-country area or agricultural zone, which FLINT could provide.

Another question which heavily affects the costs and benefits of data collection is whether there is a need to collect all relevant data from the same set of farms, or whether the policy evaluation could be based on combining alternative data sources. To answer this question, the FLINT project made a comparison between the situation where all data is collected on one farm and an estimation based on imputing data from other sources. For this purpose a number of policy analyses was not only carried out with the integrated data collected in FLINT, but also with data that were imputed from other farms where FLINT data were collected (to mimic the situation that incomplete data are gathered on different farms and then combined). Results show that imputation often leads to degrading the explanatory power of the model and blur the results regarding the relationships between the dependent variable and the chosen covariates.

Furthermore, policy-makers have to evaluate the trade-offs between different policy objectives, e.g. farm income, different environmental impacts and food security (production levels). With policy measures they try to influence the decision of a farmer in such a way that the outcome of the decision would be different from a situation without a policy. In policy evaluations, researchers try to compare these two situations: with and without a policy, in order to estimate the effectiveness of a policy. This asks for detailed data on the behaviour of the farmer and how his/her decision affects the policy objectives. It means that policy researchers are more interested in those relationships between policy, management and the exact relation between inputs, outputs and income, than in the statistical data on use of inputs or of income as such. The necessity to consider the different farm level impacts was illustrated in the FLINT project (Latruffe et al. 2016c). The results show that the effect of subsidies on farms' technical efficiency changes when environmental outputs (i.e. greenhouse gas emissions, nitrogen balance and ecological focus areas) are taken into account in the efficiency calculation. Evaluations of policies that aim to improve efficiency should therefore be based on a full set of data in relation to the management decisions of the farmer.

The foregoing strongly advocates the gathering of data as exhaustively and precisely for the same farms and at the same time. Combining data from different sources on different farms (or at different levels) strongly reduces the benefits of the sustainability data. Collecting sets of data items on different farms provides the advantage that the administrative burden of farmers could be spread if different farmers participate in different networks. It will most likely increase the total costs of data collection due to the duplication of costs items (such as farm visits, IT investments and development of (quality) procedures).

The estimation of costs as presented in this paper can be regarded as an upper bound of the costs, as the efficiency of data collection can be improved by better re-use of already available data sources (administrative, commercial and statistical) and learning effects which increase the efficiency of data collection. In case the partners of the farmer in the food chain would supplement or replace invoices on paper by digital versions, costs of management and financial accounting would drop substantially.

The FLINT project identified that many states use administrative data in compiling their FADN data set and how some have started to re-use commercial data that comes from invoices and other transaction data in a digital form. Costs of the FADN could be lowered substantially in the coming years if such a development would take off. And farmers themselves would benefit most of all.

A EIP Focus Group on Benchmarking (2016) concluded that data sharing is an important theme for innovation. In the current situation agri-businesses, such as sellers of farm inputs and buyers of farm produce send ten thousands of paper invoices and other documents per year to farmers. Farmers then have to type such data in their farm management information systems or accounting software. This is often restricted to the most needed data (e.g., financial data) where other data on the documents (on volumes of input and output or on quality indicators of the produce) is ignored, although these data would be useful for indicators on productivity and especially sustainability.

In the next years, this practice should evolve towards digital exchange with EDI (Electronic Data Interchange) messages. Novel more pro-active government approaches by public authorities could play a key role to promote EDI approaches and benchmarking sustainability. The Focus group discussions mentioned the block-chain technology as a possible solution, guaranteeing the ownership of data for the farmer and as such creating trust in a common interoperable system, which holds data that farmers may not want to share with all actors. Such principles as Single Entry and Digital by Default could help the agricultural sector and the food chain in managing its paper work and administrative burden and increase the value and use of the data in benchmarking, research and policy evaluation.

References

Abitabile, C., Beers, G., Bonati, G., Bont, de K., Del'Homme, B., Larsson, G., Linden, H. and Poppe, K.J. (1999). RICASTINGS: The implications of a new farm return on a renewed FADN. Agricultural Economics Research Institute, Report LEI 99.06. The Hague.

Asseldonk, M van, Tzouramani, I., Ge, L. and Vrolijk, H. (2016) Adoption of risk management strategies in European agriculture, Studies in Agricultural Economics 118 (3), 154-162.

Boone, J.A. and M.A. Dolman (2010), Monitoring sustainability of Dutch agriculture, 5th international conference on agricultural statistics.

Bouters, S. (2010) How pleased are farmers with the Flemish FADN? In: Boone, K. and Teeuwen, C. (eds) (2010) PACIOLI 18: Proceedings of the 18th international workshop on micro-economic databases in agriculture. LEI, part of Wageningen UR, The Hague.

Bradley, D. and B. Hill (2015), Cost of and good practices for FADN data collection, European Commission DG Agriculture and Rural Development.

Brennan, Noreen, Mary Ryan, Thia Hennessy, Paula Cullen, Emma Dillon (2016), Going beyond FADN: The use of additional data to gain insights into extension service use across European Union Member States, Studies in Agricultural Economics 2016/118/3 pp. 145-153.

Buckley, C., C.H.G. Daatselaar, T. Hennessy and H.C.J. Vrolijk (2017), Nitrogen use efficiency of milk production – A comparative study of the Republic of Ireland and the Netherlands, 91st Annual Conference, April 24-26, 2017, Royal Dublin Society, Dublin, Ireland 258616, Agricultural Economics Society.

Defra (2014) Farm Business Survey (FBS) How the information is used by Government. November 2014. Department for Environment, Food and Rural Affairs, London.

Dillon E.J., T. Hennessy and S Hynes (2010), Assessing the sustainability of Irish agriculture, International Journal of Agricultural Sustainability, Vol. 8, Iss. 3, pp. 131-147.

Dolman, M.A., M.P.W. Sonneveld, H. Mollenhorst, I.J.M. de Boer (2014) Benchmarking the economic, environmental and societal performance of Dutch dairy farms aiming at internal recycling of nutrients, Journal of Cleaner Production, Volume 73. Pages 245-252.

ECA (2003), Measurement of farm incomes by the Commission (Article 33(1)(b) of the EC Treaty. Special Report No 14/2003. Luxembourg, Court of Auditors of the European Communities

EIP (2016), EIP-AGRI Focus Group on Benchmarking: Final report; downloaded from https://ec.europa.eu/eip/agriculture/en/publications /eip-agri-focus-group-benchmarking-final-report.

Franks, J. R. and Collis, J. (2003) On-farm benchmarking: How to do it and how to do it better. Paper to the International Farm Management Congress, 2003.

Herrera, Beatriz, Maria Gerster-Bentaya, Andrea Knierim (2016), Stakeholders' perceptions of sustainability measurement at farm level, Studies in Agricultural Economics 2016/118/3 pp. 131-137.

Herrera, B., M. Gerster-Bentaya, I.Tzouramani and A. Knierim (2019), Advisory services and farm-level sustainability profiles: an exploration in nine European countries, The Journal of Agricultural Education and Extension, 117-137.

Hradiský, M. (2013) Use of FADN data in policy evaluation. 21 PACIOLI Workshop, Sweden. September 22-25, 2013.

Kimura, S., Antón. J. and LeThi, C. (2010) Farm Level Analysis of Risk and Risk Management Strategies and Policies: Cross Country Analysis. OECD Food, Agriculture and Fisheries Papers, No. 26, OECD Publishing. http://dx.doi.org/10.1787/5kmd6b5rl5kd-en

Kimura, S. and C. Le Thi (2013) Cross country analysis of farm economic performance. OECD Food, Agriculture and Fisheries Papers, No. 60. OECD Publishing. http://dx.doi.org/10.1787/5k46ds9ljxkj-en

Latruffe, Laure, Ambre Diazabakana, Christian Bockstaller, Yann Desjeux, John Finn, Edel Kelly, Mary Ryan, Sandra Uthes (2016a), Measurement of sustainability in agriculture: a review of indicators, Studies in Agricultural Economics 2016/118/3 pp. 123-130.

Latruffe, Laure, Yann Desjeux, Giffona Justinia Hanitravelo, Thia Hennessy, Christian Bockstaller, Pierre Dupraz, John Finn (2016b). Tradeoffs between economic, environmental and social sustainability: The case of a selection of European farms. FLINT Deliverable 5.2. December

Latruffe, L., Dakpo, H., Desjeux, Y., Hanitravelo, G. (2016c), Cap subsidies and technical efficiency including environmental outputs: the case of European farms, FLINT deliverable 5.2B. Downloaded from www.flint-fp7.eu

Meulen, Harold van der, Marcel van Asseldonk, Lan Ge (2016), The state of innovation in European agriculture: Innovators are few and far between, Studies in Agricultural Economics 2016/118/3 pp. 172-174.

O'Donoghue, C., Devisme, S., Ryan, M., Conneely, R., Gillespie, P. and Vrolijk, H (2016) Farm Economic Sustainability in the EU - A Pilot Study, Studies in Agricultural Economics 118 (3), 163-171.

Platteau J., Van Gijseghem D. & Van Bogaert T. (reds.) (2014) Landbouwrapport 2014, Departement Landbouw en Visserij, Brussel.

Plees, Y. (2015) FADN data and evaluations. Conference "EU-FADN – 50 years of providing information for the CAP". 11 June, 2015. DG AGRI Evaluation and Studies unit.

Poppe, K.J. (1997): Pacioli 4: Proposals for innovation of farm accountancy data networks (final reflection paper). Den Haag: LEI-DLO.

Poppe, K.J., Vrolijk, H.C.J., Dolman, M. and Silvis, H. (2016): FLINT Farm-level Indicators for New Topics in policy evaluation: an introduction. Studies in Agricultural Economics 118 (3), 116-122.

Poppe K.J. and H.C.J. Vrolijk (2018), Micro data: a critical source for policy evaluation, Eurochoices, 17(1).

Saint-Cyr L., Latruffe L. and Piet, L. (2016), Performance and subsidies in the European Union, FLINT deliverable 5.2D., Downloaded from www.flint-fp7.eu

TSC (2017), Sustainable products for a sustainable planet, downloaded from: https://www.sustainabilityconsortium.org/wp-content/uploads/2017/06/TSC-Overview-Brochure_web.pdf

Tzouramani, I, J. Zelovitis, J. Intxaurrandieta and P. Eguinoa (2017), Sustainability of the Dairy Sheep farming: Examples from Greece and Spain, Conference: Innovation for Sustainability in Sheep and Goats, FAO-CIHEAM network on Sheep and GoatsAt: Vitoria-Gasteiz, Spain, 3-5 October 2017.

Vrolijk, H.C.J. Poppe, K.J. and Keszthelyi, Sz. (2016): Collecting sustainability data in different organisational settings of FADN in Europe. Studies in Agricultural Economics 118 (3), 138-144.

Woodend, A. (2011) Farm Business Survey. In: Vrolijk, H. (ed.) (2012) PACIOLI 19: The role of FADN after the CAP reform. LEI, part of Wageningen UR, The Hague.