

Innovation in the Farm Office for Smart Sustainability Reporting

Innovation dans le bureau de l'exploitation agricole pour rendre compte de la durabilité de manière intelligente

Innovation im Büro eines landwirtschaftlichen Betriebs für eine intelligente Nachhaltigkeitsberichterstattung



point de vue

by
Krijn J. Poppe, Hans
C.J. Vrolijk and Marcel
A.P.M. van Asseldonk

The drive towards a more sustainable food system leads to more administration at the farm level. Farms are requested to show their compliance with CAP-Ecoschemes, organic certification or private sustainability schemes in the supply chain by handing in relevant data to government agencies and certification bodies. This trend will strengthen with Europe's Corporate Sustainability Reporting Directive's requirement that large retailers and food processors report their scope-3 sustainability (which includes emissions of their inputs), the Sustainable Finance Act and a trend to a more performance-oriented CAP. Farms that contribute to the Farm Accounting Data Network (FADN) also have to provide more data with its broadening to a Farm Sustainability Data Network (FSDN). To reduce administrative burdens, we posit that smart reporting is needed to meet all these demands. This will require innovation in the farm office and we offer a clear pathway for implementation of such innovations.

Some of the checks on a farm's performance can be done by monitoring from the outside, e.g. by remote sensing or earth observation systems. But even though satellite data have become more and more detailed, not everything is observable from space. Data on key performance indicators, like the use of pesticides and antibiotics, or material balances for energy and nitrate, need data from the ground. This is also the case for product

mass balances that are obligatory in the certification of organic farms. Preferably such data are already available in the farm office for farm management purposes (Vrolijk *et al.*, 2017).

“ Dans une PAC axée sur la performance, la fourniture de données sur les indicateurs de durabilité ne doit pas constituer un goulot d'étranglement si l'innovation dans le bureau de l'exploitation agricole est prise au sérieux. ”

In designing systems for the farm office that can deliver the required sustainability data, three important design criteria have to be taken into account: (1) minimise the administrative burden, (2) create systems and indicators that can also be used in farm management, and (3) guarantee a certain level of auditability. The first is important as farmers' time is precious and paperwork is seldom a favourite pastime (Reissig *et al.*, 2022). Using indicators that play a role in farm

decision-making is important to help reduce the administrative burden but also to help incentivise the farmer to act on the sustainability information in his management. Auditability becomes more important when the sustainability performance is linked to government payments or higher product prices. An exceptional case of fraud can discredit an entire system that is based on self-reporting.

In this paper, partly based on the European MEF4CAP (Monitoring and Evaluation Frameworks for the CAP) project, we propose a way forward for innovation in the farm office to enable smart reporting to produce the required sustainability indicators – and what governments can do to foster it.

Filling in forms

An obvious first step for collecting monitoring data is to ask farmers to fill in a paper form or provide farms with a form on a website and have the data entered by the farmer using his mobile phone or computer. Online applications for the CAP payments or the registration of animal movements are examples in use that illustrate how governments build their compliance systems. As a next step a digital Farm (Field) Book can be provided by the government in which the farmer records each application of a pesticide including quantity, timing and crop or even the field.

Such a solution is a nice start, but an administrative burden. Farms that use

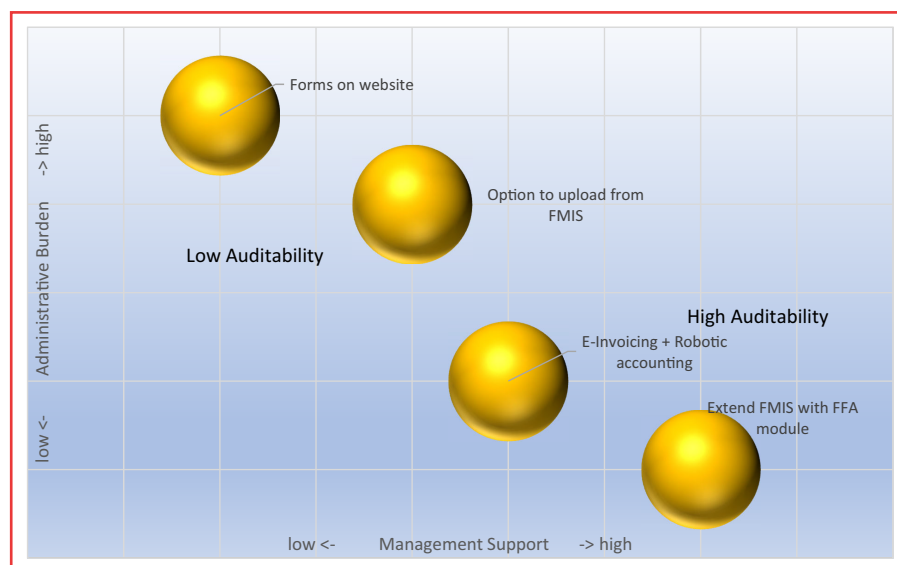
a Farm Management Information System (FMIS) would appreciate the option to upload the required data directly from their software. This reduces double manual data entry and the chance of mistakes (criterion 1). The administrative burden can also be an incentive for farmers to start using a (commercial) FMIS. This satisfies design criterion 2, to integrate sustainability indicators in farm planning and farm decision-making. FMIS are developing into central farm management tools for precision agriculture by integrating data flows from satellites and machinery. Precision farming technologies demand data (e.g. prescription maps to generate instructions for spraying machinery), and the machines and robots also generate large amounts of data at a detailed geographical scale (Poppe *et al.*, 2023). An integration between web forms and FMIS helps farmers to follow a technological pathway, in which administrative burdens are decreasing (the y-axis in Figure 1) and management is supported with more data (the x-axis in Figure 1) with the introduction of new digital solutions.

A Spanish demonstration case in the MEF4CAP project (<https://mef4cap.eu/>) illustrated this way forward by a public-private development of systems that help farmers to upload data from FMIS including data from tractors. A Dutch demonstration case showed how data on environmental emissions (e.g. ammonia, CO₂, fine particles) could be collected from on-farm sensors and added to an FMIS or farm accounting system. However, there is still work to do to distinguish individual farm emissions from the ambient levels, and such sensors are not cheap.

Robotic accounting

The reporting of sustainability data from an FMIS does not lead to extra manual input at the reporting phase, but much data still needs to be manually entered in the FMIS itself. This solution also faces limitations for design criterion 3 as the data are not auditable – it is easy to ‘forget’ to

Figure 1: Innovation options and design criteria



enter the buying or spraying of a pesticide. The solution to the challenge of manual data entry can be tackled by digitising invoices and delivery notes, that are currently often on paper or at best in pdf format. These are not computer-readable and force the farmer to type the data into web forms or the FMIS. Farmers or the accountant then also need to enter the data in the Farm Financial Accounting (FFA) software for their VAT application and on the website of their bank to conduct the payment.

“ In einer leistungsorientierten GAP darf die Bereitstellung von Daten zu Nachhaltigkeitsindikatoren kein Engpass sein, wenn Innovation in der Verwaltung der landwirtschaftlichen Betriebe ernst genommen wird. ”

Accounting offices are experimenting with scanning software to read invoices on paper or pdf, but for the moment this is sub-optimal. Some accounting offices send the hard to read invoices to low-income countries

for manual data entry. Furthermore, scanning works for the total amount of an invoice, but details on the individual items (i.e. quantity, quality, unit price) are discarded in the process. Introducing fully digital invoices and delivery notes would solve this; software could take up such messages as easily as a meeting request in a mailbox, and process it with robotic algorithms for inclusion in FMIS and FFA (and make an instruction to a bank to pay). Although technically not too difficult as standards already exist, this asks for a coordinated effort in a food chain where all companies join such a move towards digital invoices in a relatively short time span (Poppe *et al.*, 2022). The European E-invoicing directive could speed up the transition as several Member States require the use of digital invoices in business-to-business transactions in the coming years. As most invoices are made by larger input suppliers and (on farm sales) by food processors, it makes sense to include agriculture in such an obligation.

Integrate FMIS and FFA

Compliance monitoring with web forms or an FMIS is based on self-reporting and is not easily auditable. The solution to this problem can be found in FFA. Or more precisely: in an interaction and cross-check between FMIS and FFA. Although the two



Harvesting wheat and data on a German farm © Krijn Poppe

systems share a history in accounting, they drifted apart in the last century, first in their paper form and then also in their computerised form.

Accounting was mainly tax accounting and often went to special advisors who deal with tax, financial management and estate planning. FMIS stayed on the farm or with a technical advisory service.

If a farm purchases an input that is potentially environmentally damaging (e.g. a pesticide), this should in principle be recorded in FMIS. At the same time, this purchase should also be recorded in FFA in order to claim VAT and to subtract the cost in the income statement. In this way, FFA can be used as a cross-check on FMIS. Of course, farmers could decide not to report the purchase in either system, but in that case the farm is essentially imposing on itself a tax equal to the VAT rate that is not claimed. The consistency between the two systems can thus be checked in an audit (Breembroek *et al.*, 1996).

From the viewpoint of administrative burden, it would be even more attractive if there was only a single system. In large companies Enterprise Resource Packages (ERP systems, like SAP) fulfil this role of a combined FMIS and FFA. Farmers do not need all the functionality of such a complex system (with functionality for buying, inventory and sales

processes). However, a light version that integrates FMIS with FFA and repairs the historic separation, would be welcome to reduce the administrative burden and improve the quality and auditability of self-reported sustainability data. For example, it might be possible to add a module to the FMIS that handles invoices and delivery notes for a VAT application and is integrated with banking software (Poppe *et al.*, 2021, 2023).

Central databases

There are also examples, especially in the dairy sector, where existing central databases with animal registrations and milk recordings are extended with digital data from input suppliers like feed companies and veterinarians. This seems attractive from the point of view of lessening the administrative burden in the short run, although farmers still have to enter data in their FMIS, digital banking software and FFA. More importantly, it does not satisfy the design criteria on management support (criterion 2) and auditability (criterion 3) as much as an integration of FMIS and FFA. In such cases farmers have to provide General Data Protection Regulation (GDPR) compliant authorisations to the companies to transfer the data to a central database. The data transfer is typically done only a few times a

year, which makes it more difficult to use the data in operational farm management. Data from some input suppliers might not be provided – especially a risk when products are bought across the border by internet sales or because the border is close. Some farmers are also wary of approaches involving large databases as they fear less autonomy and too much government control of their data.

Policy implications

Policymakers who argue for more performance-oriented policies and food companies that become responsible for the sustainability of their inputs have an interest in data-intensive relationships with farmers (Ehlers *et al.*, 2021, 2022). For governments a number of points deserve attention:

- Information requests should be digital and should allow uploading of data from commercial software (FMIS and FFA).
- Digitalisation of invoices and delivery notes would reduce the administrative burden, but does and will require a collective approach. Precedents exist: for example, governments often require their own suppliers to provide digital invoices and banks are obliged to provide banking data in digital format.

- The European Commission is upgrading the FADN (Farm Accountancy Data Network) to FSDN (Farm Sustainability Data Network), to include a broader set of sustainability indicators. Indicators used by the government and those used by food processors and retailers on the same sustainability theme should not differ in their definition as the data have to come from the same source in the farm office. Algorithms to calculate sustainability indicators can be standardised and be provided as open source to software companies. Innovative solutions can be built in collaboration with commercial FMIS or FFA software providers and advisory services. Once data are available in FSDN, benchmarks can be published to be used by farmers, advisors, banks and others to increase the sustainability of farming.
- In a performance-oriented CAP, the provision of data on sustainability indicators does not have to be a bottleneck if innovation in the farm office is taken seriously. Again, there are precedents for making data provision mandatory, e.g. the

introduction of the VAT system and the requirement of farm accounting introduced in the 1970s for farms that applied for interest subsidies under the CAP. Very small farms (with an annual turnover of less than € 25,000 for example) could be exempted (Poppe, 2023).

“ In a performance-oriented CAP, the provision of data on sustainability indicators does not have to be a bottleneck if innovation in the farm office is taken seriously. ”

- A trust issue might arise where some farmers are reluctant to supply data. Governments, therefore, should make clear that it is better to have policies based on data on environmental performance than stronger policy instruments like the maximum number of animals per hectare, or

a total ban on a chemical input. Using an arbitrarily high default value, in the case where a farm-level specific indicator is not supplied, might convince farmers to overcome their doubts. A trusted party, e.g. a certification body, as in organic farming, between farmers and the big brother government can be a solution: such an organisation only has to transfer the end result (certified yes/no) to the government or a food chain company. It is equally important to create IT systems in which data are under control of farmers in a digital wallet and are exchanged only with authorisations.

- In some smaller sectors and specific languages, some collective or public action to create smart reporting software may be needed; currently a market solution with good competition between IT companies and their software packages / services is not guaranteed.

Support for innovation in the farm office to enable smart reporting is important and must be an important point of attention in programs for precision farming, digitalisation and



A Flemish fruit farmer working with his Farm Management Information System © Krijn Poppe



The use of pesticides per ha is a Key Performance Indicator in growing sustainable flower bulbs © Hans Vrolijk

sustainability management. Without proper recording of data in the farm office, block chain technology, application of big data analysis (Weersink *et al.*, 2018), Artificial Intelligence or concepts like True Cost Accounting and Life Cycle Assessment cannot deliver their full

potential. Smart reporting of sustainability data is within reach with innovations in the farm office.

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Krijn J. Poppe, emeritus Wageningen Economic Research, The Netherlands.
Email: kjpoppe@bcnet.nl

Hans C.J. Vrolijk and Marcel A.P.M. van Asseldonk, Wageningen Economic Research, The Netherlands.
Email: hans.vrolijk@wur.nl; marcel.vanasseldonk@wur.nl

Summary

Innovation in the Farm Office for Smart Sustainability Reporting


 Farms face an increasing administrative burden due to the push for a more sustainable agri-food system. Farms are required to demonstrate compliance with various sustainability schemes, and this trend is expected to intensify with a more performance-based CAP and new directives and regulations. The need for smart data reporting is emphasised, with a focus on minimising the administrative burden, creating useful systems and indicators for farm management, and ensuring auditability.

We advocate smart reporting as a solution and innovation in the farm office. The integration of data from Farm Management Information Systems (FMIS) with sustainability indicators is proposed in order to streamline the reporting process. The importance of using technology, such as e-invoicing and robotic accounting, is highlighted to monitor and report crucial performance data. The integration of FMIS and Farm Financial Accounting (FFA) is proposed as a solution to enhance auditability and reduce manual input. The potential benefits of fully digital invoices and delivery notes to further streamline data exchange are proposed. Additionally, the paper discusses the role of central databases in the dairy sector.

Policy implications for governments in promoting data-intensive relationships with farmers are identified. They build upon previous policy measures that involved accounting within farms and the digital exchange of data.

The paper concludes by emphasising the importance of supporting innovation in the farm office to unlock the full potential of technologies like blockchain, big data analysis, artificial intelligence and sustainability management.

Innovation dans le bureau de l'exploitation agricole pour rendre compte de la durabilité de manière intelligente


 Les exploitations agricoles sont confrontées à une charge administrative croissante en raison de la pression en faveur d'un système agroalimentaire plus durable. Elles sont tenues de démontrer leur conformité à divers programmes de durabilité, et cette tendance devrait s'intensifier avec une PAC davantage basée sur les performances et de nouvelles directives et réglementations. La nécessité d'un rendu intelligent des données est soulignée, en mettant l'accent sur la minimisation de la charge administrative, la création de systèmes et d'indicateurs utiles pour la gestion agricole et la garantie de l'auditabilité.

Nous préconisons le rendu intelligent comme solution et innovation au sein du bureau de l'exploitation. L'intégration des données des systèmes d'information de gestion agricole (SIGF) avec des indicateurs de durabilité est proposée afin de rationaliser le processus de collecte. L'importance de l'utilisation de technologies, telles que la facturation électronique et la comptabilité robotisée, est soulignée pour surveiller et communiquer des données de performance cruciales. L'intégration du SIGF et de la comptabilité financière agricole (CFA) est proposée comme solution pour améliorer l'auditabilité et réduire la saisie manuelle. Les avantages potentiels des factures et des bons de livraison entièrement numériques pour rationaliser davantage l'échange de données sont proposés. De plus, cet article examine le rôle des bases de données centrales dans le secteur laitier.

Les implications pour l'action des pouvoirs publics dans la promotion de relations à forte intensité de données avec les agriculteurs sont identifiées. Elles s'appuient sur des mesures gouvernementales antérieures qui se fondaient sur la comptabilité au sein des exploitations agricoles et l'échange numérique de données.

En conclusion, l'article souligne l'importance de soutenir l'innovation dans le bureau de l'exploitation agricole pour libérer tout le potentiel des technologies telles que la chaîne de blocs, l'analyse des mégadonnées, l'intelligence artificielle et la gestion de la durabilité.

Innovation im Büro eines landwirtschaftlichen Betriebs für eine intelligente Nachhaltigkeitsberichterstattung

 Die landwirtschaftlichen Betriebe sehen sich im Bemühen um ein nachhaltigeres Agrar- und Lebensmittelsystem einem zunehmenden Verwaltungsaufwand ausgesetzt. In dem Zusammenhang müssen sie nachweisen, dass sie verschiedene Nachhaltigkeitsregelungen einhalten. Dieser Aufwand wird sich mit einer stärker leistungsorientierten GAP und neuen Richtlinien sowie Verordnungen voraussichtlich noch erhöhen. Hierfür ist eine intelligente Datenberichterstattung notwendig, wobei die Schwerpunkte auf der Minimierung des Verwaltungsaufwands, der Schaffung hilfreicher Systeme und Indikatoren für die Betriebsführung und der Überprüfbarkeit liegen. Wir sprechen uns für eine intelligente Berichterstattung als Lösung und Innovation für das Betriebsbüro aus. Unserer Meinung nach sollten die Daten aus dem Farm Management Information Systems (FMIS) mit Nachhaltigkeitsindikatoren verknüpft werden, um den Berichterstattungsprozess zu optimieren. Die Bedeutung des Einsatzes von IT-Lösungen wie der elektronischen Rechnungsstellung und die robotergestützte Buchhaltung wird betont, um wichtige Daten zur Leistungsfähigkeit zu überprüfen und zu dokumentieren. Die Integration von FMIS und landwirtschaftlicher Finanzbuchhaltung kann die Berichterstattung verbessern und manuelle Eingaben verringern. Zusätzlich wird vorgeschlagen, digitale Rechnungen und Lieferscheine zur weiteren Optimierung des Datenaustauschs zu nutzen. Darüber hinaus diskutieren wir in dem Papier die Rolle zentraler Datenbanken im Milchsektor.

Es wird aufgezeigt, welche politischen Handlungsoptionen zur Förderung derartiger Entwicklungen bestehen. Diese bauen auf früheren politischen Maßnahmen auf, die die Buchführung innerhalb der Betriebe und den digitalen Datenaustausch betrafen. Abschließend wird betont, wie wichtig es ist, Innovationen in den landwirtschaftlichen Betrieben zu fördern, um das volle Potenzial von Technologien wie Blockchain, Big-Data-Analyse, künstlicher Intelligenz und Nachhaltigkeitsmanagement auszuschöpfen.

