NIVA POLICY BRIEF No. 4

How to use FMIS data in a CAP setting?

Farm Data has Potential for Monitoring

How to use FMIS data in a CAP setting?

EXECUTIVE SUMMARY

- ✓ To monitor performance we need more data about farming practices, in particular data about operations performed at parcels, fertilizers & plant protection products use.
- ✓ Farm Management Information Systems and precision farming data as possible data sources are not optimally used at the moment.
- ✓ This data is generated by farmers and a successful data partnership between policy makers and farming community needs to be established.
- ✓ Given the diversity of FMIS operators data exchange standards, crop lists etc. must be agreed on to boost the wider use of data sharing.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 842009

NIVA POLICY BRIEF No. 4

How to use FMIS data in a CAP setting?

Introduction

The Green Deal and the Farm To Fork Strategy acknowledge the crucial role of farming in many transitions. The European Union Common Agricultural Policy (CAP) is regarded as an potentially important instrument in these transitions.

In order to make evidence-based policy and farm management decisions, a decision making process must be supported by a sufficient amount of data that is reliable and valid. A huge amount of agricultural data is produced by farmers in the process of their everyday activities. With overall rapid progress of technology and exponential growth of the use of information systems, agriculture is exemplary – hence ICT solutions for managing farm activities are adopted by more and more farmers, however, many farmers still face difficulties to converting this data into actionable advice for their farms.

In the course of the project New IACS Vision in Action (NIVA) the potential and interoperability of farm data has been an important topic. In this policy brief we focus on farm data captured and managed via particular type of IT tooling used by farmers, the Farm Management Information System (FMIS) in relation to the CAP. It should be noted that term "FMIS" refers to such type of software collectively, not to any specific product.

The adjacent systems which are linked to FMIS are discussed as well along with data like the geotagged photographs and machine data which are relatively new instruments in the monitoring toolbox.

Performance-based CAP

The Integrated Administration and Control System (IACS), the tool defined to execute the CAP, is moving from a compliance-oriented to a performance-oriented system. IACS needs new methods to monitor the CAPs effects and ambitions. The Area Monitoring System (AMS) is introduced as an new component in IACS in support of performance monitoring. A set of common indicators has been elaborated to monitor the implementation of the CAP and assesses the performance of CAP strategic plans in EU Member States. Important keywords are conditionality and eco-schemes, rewarding farmers for implementing climate and environmentally-friendly practices.

It becomes obvious that the methods and data needed to assess how farmers are performing have to be updated as well. For example, currently data about agricultural operation (dates and type), fertilizer and plant protection products

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 842009

use are not gathered and used for CAP purposes on a regular basis. But such kind of information is definitely supporting the concept of performance monitoring. At the same time, when talking about any kind of "additional data" we must bear in mind what collecting of information means in increase of administrative burden put on farmers. Above all sharing must be voluntary. In a performance based system a farmer will have an incentive to share. But it also needs the assurance that their data is safe to share.

Farm data

To get an idea of the nature of farm data it is good to know what kind of roles a farmer has in handling data. A farmer plays a role as a natural person, a landowner/land user, manager of the farm equipment, an entrepreneur, a beneficiary of different governmental initiatives etc. In these different roles he/she generates, receives, modifies data. Data which can be used for different purposes in a monitoring process.

While talking about farm data in general, it can be categorised into the following sub-domains:

- *Farmer* data – business data and personal data (e.g. accountancy and personnel management);
- *Parcel data* – data about land management, crop production and agricultural activities (e.g. location of the agricultural land, crops, dates of performing agricultural operations, fertilizers or plant protection products application data);
- *Animal data* - data about livestock production (e.g. type and number of animals, animal husbandry practices, animal health);
- *Additional data related to a farm generated by other stakeholders in food supply chain* – e.g. data generated by suppliers and clients of the farm, farm advisors, government authorities.

In the NIVA project, main focus has been on the data related to agricultural parcels and therefore this policy brief is also concentrating on this. However, we acknowledge that from the perspective of successful data use and knowledge management, all domains are important.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 842009

NIVA POLICY BRIEF No. 4

How to use FMIS data in a CAP setting?

Farm Management Information System (FMIS)

As for other domains, digitalization has a huge impact on farming – paper based recordkeeping is being gradually replaced by the electronic records, use of precision farming tools is more and more common. Modern farming machines are able to collect a large amount data during working process, smart sensors are recording data about soil and weather, etc. Data is constantly generated both by man and machines and use of specific information systems has become a usual practice in many farms.

FMISs are tools specifically designed for helping to manage everyday activities in farms, from tasks and personnel management to crop planning and yield estimation.

Functionality of FMIS

- Field Operations Management
- Best practice (incl yield estimation)
- Finance
- Inventory
- Traceability
- Reporting
- Site Specific
- Sales
- Machinery Management
- Human Resource Management
- Quality Assurance

Adopted from: Fountas (2015)

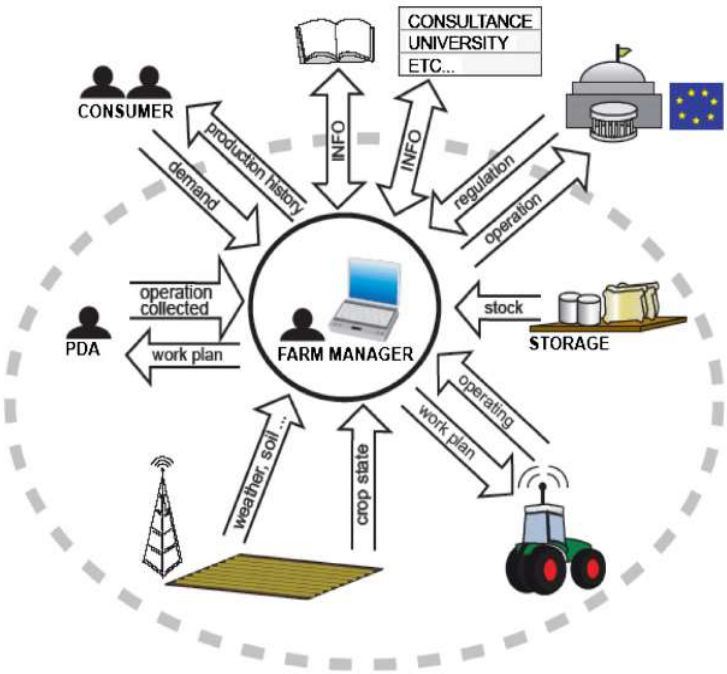


Figure 1. An conceptual model of a Farm Management Information System (Adopted from Burlacu et al 2016)

In addition to being a useful tool for farmers in handling their everyday activities, FMISs should be acknowledged as an important source of data. If this source remains isolated the development of intelligent decision tools will stagnate.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 842009

How to use FMIS data in a CAP setting?

Farmer Field Book

As described in previous chapter, FMIS type of software can have multitude of functionalities, from field operations management to human resources management, sales and finances. The data relating to operations performed on parcels; yield, fertilizer and plant protection products use, form a subset of farm record keeping, which basically is mandatory – farmer field book[1] (or farmer field record, terms used may vary from country to country). Requirement for this type of record keeping arises from Nitrates Directive, aiming to reduce and prevent water pollution by establishing good agricultural practices and measures.

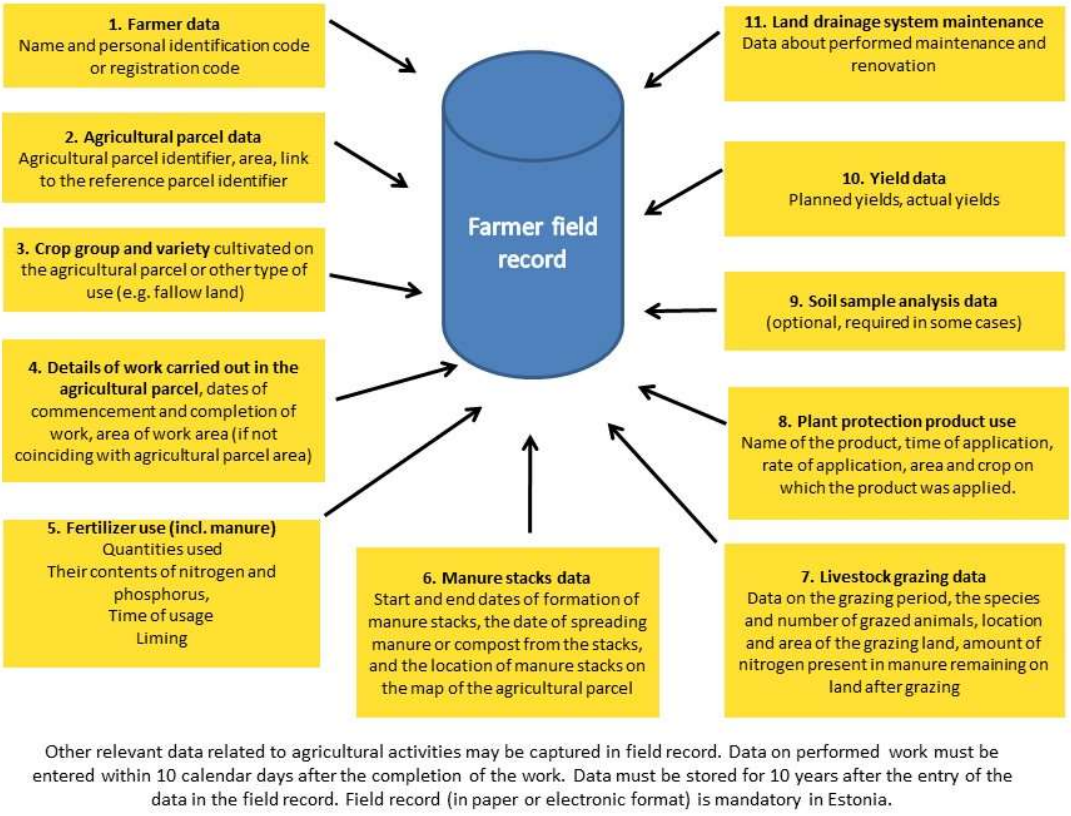


Figure 2 Dataset of farmer field record (field book) Estonia

Issues to be addressed and potential solutions

In NIVA two use cases worked with FMIS data, UC1C and UC4B. The use cases aimed to improve mutually beneficial exchange of data between the IACS and a

[1] Different terms may be used, e.g. farmer field record, farmer notebook, farmer's calendar.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 842009

farmer. UC1B worked on the exchange of field book data with IACS, UC4B created a flow from farm machine to PA database. Generalizing NIVA experience, there are three main types of obstacles to overcome in order to make the wider use of FMIS data in CAP context possible:

- Technical and semantical issues;
- Integrity issues;
- Legal issues.

Technical and semantical issues

From technical and semantical point of view the main issue hindering broader exchange of agricultural data between different systems (meaning both many commercial software and many information systems of government agencies) is lack of interoperability. Diverse data models, lack of data exchange APIs standardization and lack of common code lists result in a highly fragmented data ecosystem. Or as it is formulated in a paper about AGROVOC[2], published by FAO - "While there has never been as much data and information available as now, it is not always simple to find the right information: it is distributed, fragmented, and often compartmentalized" (FAO 2021).

NIVA WP3 research done about currently available standardised data models of different agricultural domains showed that although there are several data models available which provide potential solution to semantic interoperability this issue still remains unresolved (see NIVA policy brief: Common Crop Type List for CAP).

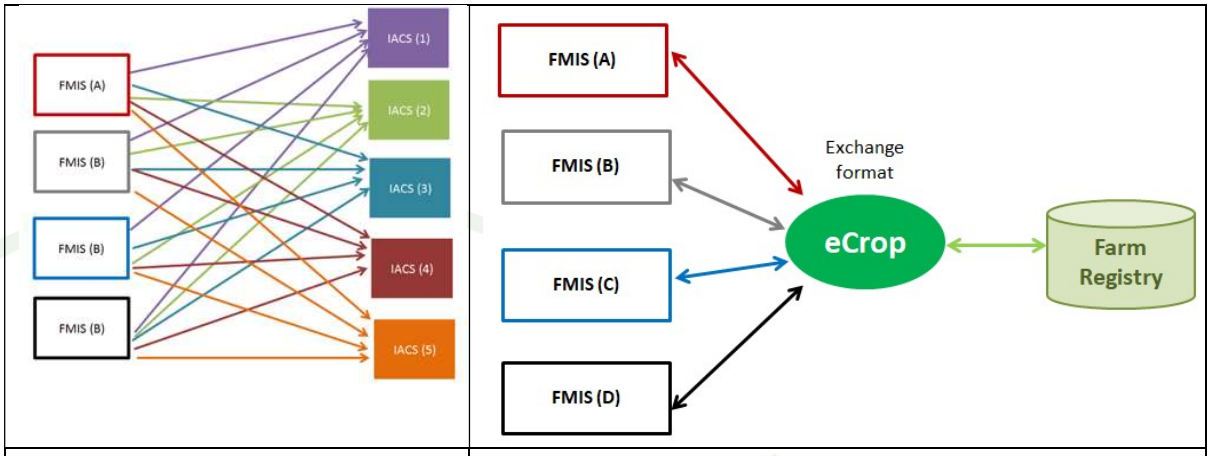
Standardisation of agricultural data models can significantly contribute in resolving the issue of semantic interoperability, but the question of technical interoperability still remains. It is clearly not reasonable nor possible to expect rapid and simultaneous updates of already existing systems to enable seamless integration with one another. Software industry's current best practice to enable technical interoperability is considered to be the use of lightweight

[2] https://www.fao.org/agrovoc/

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 842009

software modules that "translate" custom datasets into a standardised data model.

The NIVA project has elaborated a potential scenario that can solve some of the interoperability issues mentioned above, at least for the exchanges of data related to "field operation management" (what is currently the main target).



Potential data exchanges between FMIS and IACs before the NIVA project	NIVA proposal for more standardized exchanges between (new) IACS and FMIS

Figure 3. Benefits of NIVA proposal for data exchange between FMIS and IACS

This scenario is based on the use of the UN/CEFACT standard eCrop, to be used as exchange format between various FMIS and the data model on Farm Registry designed by NIVA-UC3 that is expected to be integrated in new IACS and to act as a common receiver of FMIS data.

In this scenario, the Paying Agency has to design the profile of the eCrop message to be used (e.g. to exchange field activity data necessary to check an eco-scheme or to compute an agro-environmental indicator) and it is up to the FMIS editor to develop the relevant export function. Some technical and semantic issues still have to be solved (e.g. lack of agreed code lists at European level).

On the exchange from machine (tractor/implement) to FMIS is also an interoperability issue. Here also many different machines can talk to many different FMISs in there proprietary data exchange format. In NIVA UC4B this

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 842009

was addressed. Common machine data formats like ISOxml (market) and ADAPT (science) were assessed. This resulted in building a ISOxml- eCrop Library.

Integrity issues

Next to semantical technical and legal issues, integrity issues is a forth issue to consider. Using FMIS data for monitoring purposes can also have data integrity issues for the monitoring system. When data of an applicant for CAP subsidy is used to monitor the subsidy this undoubtedly has risks. Farmers may be tempted to adjust their data to achieve a desired outcome. Managing and ensuring the quality and integrity of FMIS data is an important caveat on which there is still much to be developed. Cross checking with other data can be an option. Certainly in the further future when more data is available.

In NIVA's UC4A, progress was made on maintaining data integrity by building checks in the (Geotagged Photo App (GPA). The GPA is a PA controlled application where a PA can introduce this kind of assurances. It is complicated to introduce these checks into a commercial software package as an FMIS. An unexplored and relatively new insight is in certifying FMISs on this point.

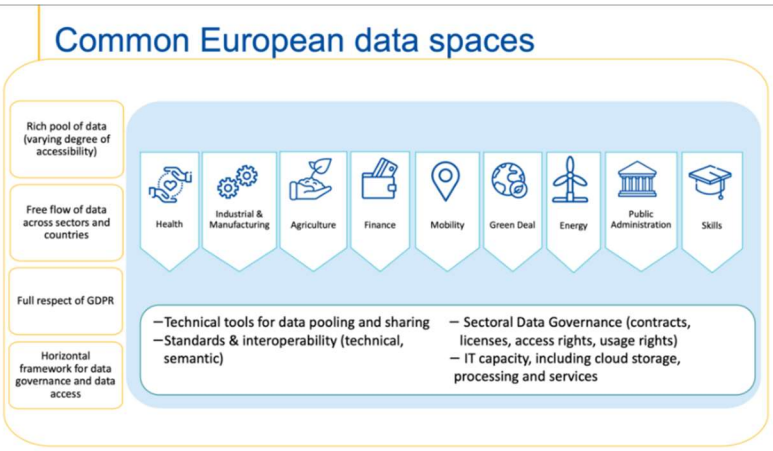
Legal issues

The main problem currently is the lack of strong driver: until now, the use of FMIS data for managing CAP payments is not foreseen by the existing regulations. Implications on the potential use of FMIS data have two legal and policy dimensions. Firstly on the regulations which are developed by the European Commission on Area Monitoring System (AMS) and secondly (more general) acts on digital Europe. In NIVA we have demonstrated that there is potential to use FMIS data in the AMS for monitoring the farmer activities.
In developing the regulation on AMS, the committee is open to including other data sources. FMIS data is not been brought forward yet.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 842009

How to use FMIS data in a CAP setting?

A second field of policy to regard is European Strategy for data. This strategy aims to achieve a common European data space (a single market for data) where data can flow freely, with European values in mind. Specific data spaces are designed focussing on specific areas. An agricultural data space and green deal data space, would seem most relevant for exchange of farm data.



RECOMMENDATIONS:

- Acknowledge Farm Management Information Systems' data (and precision farming data in general) as useful and acceptable in CAP context.
- Encourage data sharing by promoting data exchange between commercial agricultural software (like FMIS) and information systems used by government agencies (like IACS).
- Promote benefits of such data sharing – less time spent on filling applications or providing mandatory information for statistics, possibility to develop and offer more advanced advisory services to the farmer based on aggregated datasets.
- Continue to develop and agree upon semantic and technical standards for enhancing data exchange between FMIS providers and IACS systems managed by PA's.
- Place FMIS data on the agenda at the European Commission as an potential monitoring data source.
- The European Strategy for Data aligns with the strategic direction of connecting FMIS and IACS systems and offers an opportunity to deal with many of the obstacles which are currently felt.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 842009

How to use FMIS data in a CAP setting?

Sources

George Burlacu, Ruben Costa, João Sarraipa, Ricardo Jardim-Golcalves, Dan Popescu. A conceptual Model of Farm Management Information System for Decision Support. 5th Doctoral Conference on Computing, Electrical and Industrial Systems (DoCEIS), Apr 2014, Costa de Caparica, Portugal. pp.47-54, 10.1007/978-3-642-54734-8_6

S.Fountas[a]G.Carli[b]C.G.Sørensen[c]Z.Tsiropoulos[d]C.Cavalaris[d]A.Vatsanidou[d]B.Liakos[d]M.Canavari[e]J.Wiebensohn[f]B.Tisserye[g] 2015 Farm management information systems: Current situation and future perspectives Computers and Electronics in Agriculture Volume 115, July 2015, Pages 40-50 https://www.sciencedirect.com/science/article/pii/S0168169915001337

FAO. 2021. AGROVOC – Semantic data interoperability on food and agriculture. Rome. https://doi.org/10.4060/cb2838en accessed 12 May, 2022

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 842009