I. The CAP post-2020 Farm Sustainability Tool for Nutrients (FaST) [i]

The **use of a Farm Sustainability Tool for Nutrients** (FaST) is part of the newly adopted Commission proposals on the 2021-2027 Common Agricultural Policy (CAP)[1]. It is included in the new framework for standards of good agricultural and environmental conditions of land (GAECs). The obligation for the farmer, according to GAEC 5 in Annex III[2] and article 12(3)[3], is to "use" it, i.e. activate it and input the necessary data for the tool to be operational (farm information not already available from other sources, such as IACS, LPIS, soil test values, etc.).

1. Why

Win-win solution beyond compliance model: The idea is that the support provided by the tool will be clearly beneficial for farm management, ensuring **buy-in and environmental gains not through imposing obligations, but through creating conditions for behavioural changes that make sense also from an economic point of view.** The farmer, accompanied by a farm advisor if necessary, would follow the indications provided by the tool because they will be **clear, timely, simple** and beneficial for farm management. It will help farmers to optimise their use of nutrients, and therefore their income, while protecting water quality and cutting greenhouse gas emissions through a more efficient management of inputs.

The FaST will not be a tool for authorities to check on farmers and their input levels. Where the farmer has the obligation to produce a nutrient management plan under SMR 2 "Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (OJ L 375, 31.12.1991, p. 1): Articles 4 and 5"(Nitrates Directive), the farmer can choose to use the output of the FaST in this respect, for reasons of simplification. Nevertheless, no checks on SMR2 will reflect on the conclusions regarding compliance with GAEC 5.

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[1] Proposal for a Regulation of the European Parliament and of The Council establishing rules on support for strategic plans to be drawn up by Member States under the Common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) - COM/2018/392 final - 2018/0216 (COD)

[2] "The Tool shall provide at least for the following elements and functionalities:

a) Elements

- Relevant farm information based on LPIS and IACS;
- Information from the soil sampling , on an appropriate spatial and temporal scale;
- Information on relevant management practices, crop history, and yield goals;
- Indications regarding legal limits and requirements relevant to farm nutrients management;
- A complete nutrient budget.

b) Functionalities

- Automatic integration of data from various sources (LPIS and IACS, farmer-generated data, soil analyses etc.) as far as possible, to avoid data input duplication for farmers;
- Two-way communication between PA/MAs and farmers allowed;
- Modularity and possibility to support further sustainability objectives (e.g. emissions management, water management)
- Respect of EU data inter-operability, openness and re-use principles;
- Guarantees for data security and privacy in line with best current standards."

[3] "Member States shall establish a system for providing the Farm Sustainability Tool for Nutrients referred to in Annex III, with the minimum content and functionalities defined therein, to beneficiaries, who shall use the Tool.

The Commission may support the Member States with the design of that Tool and with data storage and processing services requirements."

The **MS may choose to provide financial support to the farmer for any soil testing going beyond existing legal requirements** (either present in national norms or mandated under the Nitrates Directive).

EU-wide environmental impact: The tool will be provided by MS to all CAP beneficiaries. This will ensure the potential scale needed for a meaningful environmental impact. The fact that the application would serve as a basis for other on-farm digital applications (e.g. emissions management, water management) it would extend its potential environmental **impact beyond nutrients management**.

Simplification of the farmers' tasks is the second main driver of the idea. Relevant data entry would be reduced to minimum and **data input duplication would disappear**, as the tool should integrate as much as possible the relevant information available to public authorities (IACS, LPIS, but also other databases and public records).

The **messaging component** - Two-way communication between the farmer and the PA/MAs – would allow farmers to receive timely pertinent indications and updates and would allow the public authorities to share helpful information, news and updates ('nudges') in the form of short **communications directly to the farmer's device**. It would allow e.g. digital applications for CAP payments by farmers or sending photos for control purposes.

Catalyst for on-farm innovation and digitalisation for the local, EU and global agricultural knowledge and innovation systems: The FaST could be the **on-farm landing spot for many services** provided by commercial third parties, from machinery and input producers to decision support services based on digital technologies (remote sensing, geo-positioning, machine learning, internet of things).

Given the minimal data entry required and its streamlined functionalities, the use of **the FaST will not entail a displacement of more sophisticated commercial decision support tools** used on the farm. It would be able to take in data provided by such tools already present on-farm, while possibly serving as a core/basis for additional on-farm digital technology, thereby boosting digital innovation in the sector.

Optimising data use: The Tool will have as a benefit the fact that **farm data (gathered by various public authorities, farm advisory services or private parties) are 'returned' to the farmers**, who have control over the information pertaining to their farms, easily accessible on their mobile devices. The system will guarantee both the anonymization of personally identifiable information (P.I.I) and differential privacy.

2. What

The **mobile application should visualise the LPIS farm boundaries** and other existing information in user-friendly customisable layers. It should be able to integrate further modules/apps/widgets, driving localisation and diversification of services to farmers (advisory services, commercial services etc).

The potential is for it to develop into the **'on-farm, digital and mobile terminal'** for most interaction between the farmer and the MA/PAs (to support payment applications, adhesion to and implementation of various contracted commitments, information exchange/notifications etc.).

Its modular and minimalistic structure will provide a platform and increase the market for **smaller, possibly more innovative service providers**, for researchers or farm advisors, for whom the FaST open source 'core module' will act as **on-farm entry support**.

3. How

The **rollout of the FaST** should be consistent with the implementation timeline of the post-2020 CAP.

In order to support MS in this process**,** the Commission may made available **a demonstrator FaST and its documentation**, as well as an **outline of an overall IT architecture** supporting the functionalities of this tool.

MS having already developed similar tools would need to ensure their **compliance with the minimum requirements and functionalities** indicated in Annex III of the CAP Plan Regulation.

Consistent with the implementation timeline for the new CAP **Member States that do not have any such system in place** will have the choice to:

i) develop/customise/localise the provided FaST demonstrator;
ii) to develop their own tools; or
iii) acquire (and adapt) a decision support tool already existing on the market.

Support provided by the Commission:

1. The prototype (demonstrator) FaST

The demonstrator tool:

- Will be in the form of a web application (able to run in a recent browser or laptop/tablet/ mobile).
- Will present the forms for the various uses: user input, messages, maps, graphs.
- Will also incorporate the basic usage of sensors available on the farmer's mobile terminal (positioning, camera, compass etc).
- Will offer basic offline capabilities.
- Will offer rudimentary (backend) administration application: user management, main settings, manual data export etc.

2. Outline of IT (data and services) architecture to support the FaST

An overall information technology architecture supporting the functionalities of this tool would need to:

- Optimize resource utilisation and costs;
- Scale to large volumes of data;
- Enable modular and extensible services;
- Run on an EU DIAS[4] platform or any cloud provider.

The prototype and its documentation, together with an IT an IT architecture outline, **may be made available in 2019** to support informed decision by the MS on what option is more suitable. A**dvisory systems will be essential in the rollout of the tool.** The **training of farm advisors** on how to best support farmers should be considered as early as possible in the rollout plan.

[4] Copernicus cloud-based platforms for Data and Information Access Services (DIAS)

II. Agricultural Policy& digitalisation in the EU – a few general considerations informing the work on developing the Farm Sustainability Tool for Nutrients (FaST)

Hypotheses:

1. Data availability, reliability, interoperability and openness will strengthen, not weaken the farmer's data ownership.

2. The EU is particularly well-positioned to pioneer the digital transformation of European agriculture by optimising both on-farm and CAP processes through setting up a common digital eco-system for agriculture based on open data and data sharing principles.

3. Future-proofing the CAP digital architecture means decoupling backend systems from front end presentation (moving away from creating and maintaining separate datasets for one purpose only) and choosing architectures suitable for data reuse and machine learning: e.g. a data and information access services platform + an open application programming interface (API) + various apps. Such a system would be would be dynamic, open and a catalyst for digital innovation both on the farm and in public administrations at all levels.

1. Improved data availability and management.

Things to consider:

Data inventory: variety and completeness of datasets. CAP systems (IACS and LPIS) are developed nationally for instance and, apart from core specifications developed by the Commission's Joint Research Centre, data is fragmented and widely distributed. For example, farmers having participated in agro-environmental schemes (1/4 of EU's UAA) have produced inevitably more data for these systems (types of crops, farming practices etc) than others. Other nationally/locally-developed datasets, might be useful, but even more challenging – with historical data sometimes not even digitised (e.g. soil samples).

Data quality: images at compatible resolutions, proper geotagging etc.

Data variety: AI and machine learning algorithms for activity optimisation need sufficient training data to develop their predictive capacities before they can be deployed with confidence. In addition, the sought outcome dataset should provide enough diversity to be employable by a variety of users (different farming systems, variations in regulatory environment etc).

Data security: The systems can guarantee the anonymization of personally identifiable information (P.I.I) and differential privacy, ensuring accurate statistics/monitoring with adequate privacy. Data security poses known challenges, generally not specific to the agricultural sector.

Data availability and ownership: The EU is in the privileged position of potentially having a wealth of data on farming practices due to its CAP. The CAP has a common monitoring and evaluation framework, but that still does not incorporate the wealth of detailed information gathered by the IT systems developed at MS and regional levels for CAP implementation. Currently, **the majority of farm data is held by CAP implementing public bodies** (national and regional paying agencies, managing authorities**,** auditing bodies)**, by farmers' organisations, agricultural advisory services or commercial entities**. This is particularly true for small farmers who cannot afford costly data services offered by commercial entities, provided by in-house consultants or data from sophisticated precision machinery/sensors.

With regard to the **CAP's Land Parcel identification System (LPIS),** for instance, few EU Member States allow data to be downloaded, i.e. allow the farmer to potentially have the electronic version of their farm boundaries as used by the authorities, with half of the other EU members allowing read access (map viewers). All this while land parcel information is not considered personal information and there is strong unequivocal EU legal basis for open-data and data-sharing policies.

An open-data approach would allow all interested actors, including the farmers, access to data as collected at source at the lowest granularity determined by privacy, security or data accuracy considerations.[5] First and foremost, all farm data (raw data) would become actually accessible to the farmer who currently relinquishes control to various other actors and receives back processed information or instructions.

With a system based on a data and information access services platform + open application programming interfaces (APIs) + various apps, farm data would be available to all interested in processing it[6] (including the farmer herself) and in 'returning' it as useful information to the farmer.

2. Optimisation of decision-making

At farm level – optimisation of **farm inputs, agronomic processes**: through precision agriculture, IoT, targeted advisory services -> precision farming can embed environmental benefits in agronomic practices themselves, an alternative approach to the "income foregone and costs of voluntary practices/commitments" approach of CAP voluntary support measures to date; e.g. the right tools and advisory services for nutrient management allow both for a reduction in fertilizer use and improved farm agronomic performance.[7]

At governmental level – optimisation of **regulatory framework, design and implementation of measures, monitoring and control**: through standardised, virtualised and centralised data platforms and an overall effective e-government architecture -> shift from a compliance-based policy towards a service-to-farmer approach. EU systems until now used for checking compliance can be used for returning useful information to farmers, two-way communication, administrative simplification.

The improvement in quality and variety of monitoring data not only allows for a better assessment of the measures' outcomes, but allows for the design of new measures, impossible in the absence of the digital eco-system (e.g. intervening on the exact areas where nutrient run-off occurs with the help of algorithms that interpret LIDAR images). Public data can be mined for ad-hoc questioning and for returning useful information for real-time adjustments of measures.

3. A quicker and better policy feedback loop

This is based mainly on the engagement of the knowledge-base. Key stakeholder buy-in and constant engagement are important to keep up with technological changes. The architecture chosen needs to be future-proof, able to incorporate new data sets, new algorithms and users.

- future-proofing public support for **digital infrastructure and hardware solutions** is crucial: in some cases, public tenders for rural broadband infrastructures have been lacking ambition

[5] https://www.gartner.com/newsroom/id/3360317
[6] Keeping in mind differential privacy, anonymization etc.
[7] A recent pilot carried out on 1000 farms in a MS showed that data-driven farming has brought average on-farm savings of € 8,700/year (with nutrient management accounting for almost half of the savings), with an average emissions reduction of 10%. http://smartfarming.ie/wp-content/uploads/2017/10/SFRF.pdf

so that by the time the investment was functional the specifications were obsolete (e.g. internet at 2 Mbs financed in the 2007-2013 period through Rural Development Programmes).

- e-government digital eco-systems should adopt architectural patterns that simplify the process of repurposing and coordinating services: e.g. **decoupling backend architecture from the client-side layers**, insisting on the quality of the former and the adaptability of the latter. E.g, by using:

  - data and information access services platforms (the EU is preparing to launch DIAS[8]) and

  - open application programming interfaces (apps instead of traditional web-based interfaces): participatory design, **participatory development ensures buy-in**, which in its turn can keep the system alive, healthy (increased use reinforces reliable de-bugging) responsive and resilient. Apps developed as need be, by public bodies, research and farm advice services, and commercial entities. Challenges: reliable security, identity, monetisation (e.g. for farm service providers) and scaling functionalities.[9]

Future proofing strategic indications for supporting the digitalisation of agriculture and of agricultural policy:

A future-proof approach to 'strategizing' on digital policy in agriculture would quite likely need to be a dynamic one, focused on identifying operational elements needed to obtain the most ambitious results possible. It would therefore pay to assess risks and obstacles directly in relation to concrete objectives (checking data availability and quality, testing the effectiveness of algorithms in providing useful indications, ensuring the scalability of solutions proposed, maintaining a lively feedback loop). A static approach based on lengthy status quo mapping exercises risks to anchor the exercise too much into a 'present' that quickly becomes 'past' thus nullifying the usefulness of a digitalization strategy.

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[i] This text represents solely the views of its author and can not in any circumstances be regarded as the official position of the European Commission. This text and any accompanying visual materials are only for information purposes and any inaccuracies or errors are entirely attributable to the author.
The text of the post-2020 CAP proposal is available online:
https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=COM:2018:392:FIN&rid=4

[8] http://copernicus.eu/news/upcoming-copernicus-data-and-information-access-services-dias
[9] https://thenewstack.io/future-proof-digital-strategy-delivering-services-app-age-beyond/