Expert Workshop on a Common European Agricultural Data Space

IoF2020 - Position Paper on a Common European Data Space

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IoF2020 - Position Paper on a Common European Agricultural Data Space

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Purpose: Input for discussion at the expert workshop on a Common European Agricultural Data Space, (Webinar on September 8th 2020, 09:30-12:30

The position paper shall provide input to the following questions pre-defined by the workshop organisers:

1. Is the federation of some of the Farm Management System (FMS) platforms and other data platforms feasible?
2. Assuming that the implementation option for the Common European Agricultural Data Space for agriculture is based on a federated distributed system of existing data platforms, what is needed to implement a European data space from a technical point of view (definition of the interoperability mechanisms)?
3. How can we reach an agreement on a set of interoperability mechanisms (avoiding locking into existing platform architectures)?
4. Are the suppliers of FMS ready to share their data? And willing to federate their data platform with other suppliers?
5. Which existing platforms supported by ecosystems (at regional or national level) are already sharing data? In which sub-sectors are they sharing the data?
6. Which public data sets would be of particular relevance for increasing the effectiveness of the Common European Agriculture Data Space?
7. Are their experiences with taking public data sets as input to FMS, farmers` applications or agricultural data spaces?

Federation of Farm Management Information Systems (FMIS) or other data platforms

An FMIS is operated in the application layer with respect to the IoF2020 IoT Architecture Reference Model as presented in the IoF2020 report "D3.3 Opportunities and Barriers in the present regulatory situation for system development". Therefore, it can be characterised as a system, consuming diverse type of data that is generated in the farm or received from other sources. Data generated by the farmer's field machinery is usually not fed directly to the FMIS but gathered by OEM operated cloud applications and forwarded to the farmer's FMIS, using existing data formats and exchange standards that were developed over decades.

At the same time, there are different types of FMIS. They have a different specialisation with respect to agricultural sectors as well as amount of offered features. From an architectural perspective, one needs to differentiate FMIS as local installations at farm sites with a defined feature set, or FMIS that are operated as cloud-based systems offering a kind of service based environment with the selective usage of a portfolio of features. All those FMIS are using diverse kind of data – from quite stable master data, up to operational data, required for the planning and control of farm activities.

Taking into account the number of FMIS and related data platforms, there is neither one truth or just two categories of systems. It is rather a colourful landscape of devices, systems, interfaces and semantics that are serving diverse purpose as well as following diverse design philosophies.

Having understood this complexity, there are already some initiatives like DKE agrirouter, DjustConnect or JoinData that are facilitating the interoperability issue with platforms that are explicitly connecting systems and devices, by "handcrafting" specific interfaces that are transporting data from one system to others.

All this is still not representing a federated system architecture, or a system of systems approach that will allow an easy access for new business, startups or other initiatives that would like to take advantage from available data. Nevertheless, ***cloud based systems and facilitators for interoperability are somehow proving already the feasibility towards a federation of systems***.

At the same time, new challenges are at the horizon asking for adequate strategies for being able to handle data, information and knowledge ownership as well as to avoid security threads that could lead to dangerous threads to system-relevant sectors, represented by the agri-food chain.

Therefore, we consider a federation of existing systems generally feasible, while the underlying complexity and heterogeneity of the agri-food sector cannot be realised in a one-size-fits-all approach. Initiatives shall

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rather try to structure the agri-food domain with respect to specific characteristics that could help reducing complexity as well as put a focus on certain initiatives with highest relevance or impact. Without claiming to provide a complete listing of characteristics, the following collection shall rather trigger the discussion and facilitate a search for pragmatic solutions of highest impact and usefulness also for the farmer as key stakeholder:

- Focus on specific agri-food related sectors:
  It highly determines the relevance of devices, processes, seasonal dependencies, harvest frequencies, infrastructures, systems, and involved stakeholders, while there are a lot of sector specific solutions. IoF2020 considers it rather useful to focus on sector specific approaches than aiming at a jack of all trades device.
- Purpose of a system federation:
  As the rational of the workshop aim at "*allowing for precise and tailored application of production approaches at farm level*", the farmer needs to be considered as key stakeholder to benefit from developments. However, taking into account the interest of equipment manufacturers, food industry, ICT providers, authorities and finally all of us as consumers, to highlight just a few of stakeholders, one needs to carefully manage the expectations of the specific stakeholders.
- Type of data considered:
  Data needs to be categorised. Just some perspectives could be time (from stable to operational control data), reusability (from master data to data just kept for documentation), confidentiality (from public to private data), or purpose (e.g. used for analysis, planning, control, monitoring, or identification).

However, a federation of systems would need to clearly balance the effort and benefit for the different stakeholders to assure acceptance.

What is needed to implement a European data space from a technical point of view?

At first, we would like to go a step back, before defining the interoperability mechanisms. In order to enable adoption of a federated FMIS infrastructure and IoT technology in the agricultural sector, the main prerequisite is the existence of the necessary digital infrastructure. In general, but especially in rural areas there are lacks which need to be addressed. The areas are:

- Fast Fibre Optic Networks in order to provide high-speed internet access
- Implementation of 5G mobile networks with a broad coverage for mobile internet applications, e.g. in farm management systems, where high amounts of data need to be transmitted.
- Setting special focus on IoT networks, as for many IoT-applications only small bandwidth is necessary, as LPWAN (Low Power Wide Area Networks) technologies play a crucial role in adoption of IoT.

IoF2020 calls upon the European Commission to promote the development and implementation of a strategy for digitisation in agriculture at the national level - in all member countries. This requires a joint and coordinated approach by the Commission and the different EU-nations.

However, with respect to the definition of interoperability mechanisms, IoF2020 is considering a "system of systems" approach as viable element, facilitating integration of systems with FMIS within a farm as well as participation of FMIS into Data Spaces of different nature where organizations are able to create innovative value chains based on the exchange of data.

We consider the usage of a standard context information management layer, leveraging on the standard NGSI-LD API defined by ETSI, as a key enabler to facilitate this approach:

- Integration of systems within a farm can be achieved by means of sharing data each system publishes and consumes about context in the farm, defined as collection of properties of entities working as "digital twin" of assets in the farm. FIMS can rely on this shared context information management layer to gather information needed to implement their functions as well as to publish data which vertical integrated systems may require and govern the exchange of data among integrated systems.
- Participation of FIMS into Data Spaces can be achieved because the FIMS can publish data other organizations may be willing to consume and vice versa. Effective data exchange can be achieved because organizations participating in the Data Space know in advance how each participant exports data (i.e., using the NGSI-LD API) and what kind of data (i.e., properties of context entities = digital twins).

Core mechanisms can be considered as listed in the following:

- Open Source Software implementing common features (e.g. gateways, context broker, identification, authentication, authorisation, monetisation) that can be easily deployed by system developers, being open for different FMIS architectures and data models.
- Repositories that are referencing available data models, code lists, and master data.
- Open access for the usage of data models and master data, not requiring payment of membership fees.
- European regions/governments shall assure a harmonised approach, content, data models and systems/ interfaces that need to be served by FMIS for the purpose of legal reporting by farmers.

IoF2020 promotes related initiatives and would like to highlight the following web-based resources:

- Agrifood Data Models - https://github.com/smart-data-models/dataModel.Agrifood/tree/master
- Library of Codelists and Reference Data - https://market.ioflab.opplafy.eu/#!/offering
- Service Monetization - https://coatrack.eu/ and https://github.com/FIWARE-TMForum/Business-API-Ecosystem
- FIWARE Context Broker - https://fiware-orion.readthedocs.io/en/master/index.html
- IoT Catalogue - https://www.iot-catalogue.com/

These resources are kind of building blocks that are addressing mainly ICT developers. At the same time, they could complement platforms like DKE agrirouter, JoinData or DjustConnect with the underlying objective to facilitate interoperability and development of APIs, while such platforms are helping specifically farmers to manage the permissions/authorisations for third parties to use the farmer's specific datasets.

Matching the needs of different stakeholder audiences could also focus on farmer-centric innovation that can help to balance potential added-value and costs for the different stakeholders involved. At the same time, clear technical agreements can facilitate the analysis and handling of ethical aspects.

Toward agreeing on a set of interoperability mechanisms

As highlighted above, initiatives in different European regions are already facilitating the interoperability of diverse devices, systems, and infrastructures. However, aspects like architectures, costs, governance and competition are challenging the related implementations.

Therefore, as a first step we consider a pragmatic initiative as beneficial to help FMIS and other platform providers reducing implementation effort and maintenance costs. This could facilitate a collaboration of FMIS/ platform providers as well as avoiding anti-competitive agreements. Examples for such initiatives could be the following:

- Public authorities are providing required master data for reporting purposes in a standardised way and free of charge.
- Many digital solutions for agriculture require up-to-date and accurate geodata, which are already being collected by the Member States. They shall be made available in a unified machine-readable and open data format free of charge and in real-time. All geodata collected by public agencies and authorities, from the municipality to the European level, should be made freely accessible. An agricultural geodata portal should be set up. This includes not only the relevant geospatial data, but also geodata services and API, allowing easy integration of information into software environments.
- Public authorities are harmonising their reporting interfaces over regions and EU countries towards one EU approach for data reporting.
- As part of the CEF Digital program[1], the EC is identifying a set of Building Blocks which can bring fundamental components for interoperability agreed across EU member states.
- Standard development or similar organisations are providing free access to their standards, data models, and master data for FMIS and platform developers.
- Standard development or similar organisations are publishing their resources in central repositories (e.g. data marketplace type of implementations) to facilitate access for software developers, avoiding reinventing the wheel.

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[1] https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/CEF+Digital+Home

Moreover, FMIS providers shall offer documented APIs, enabling service providers either to consume data from the FMIS or provide their service as integral element of the FMIS offering. On top of that, standards for unique identifiers require an additional attention since they are providing a required baseline to allow tracking and tracing from farm to fork. Typical examples are identifiers from GS1 like GLN, GTIN, GPC, but also other identifiers like GGN from GlobalGAP.

Are the suppliers of FMIS ready to share their data? And willing to federate their data platform with other suppliers?

FMIS and other platform providers are usually commercial entities that are offering their products and services in a competitive environment, based on different business models. These business models are usually driven by the nature of the ICT providers (e.g. relation to equipment manufacturers, suppliers of farmers, farmers associations). A complete openness of all data and possibly software services could jeopardise the competitiveness of individual suppliers as well as of the European industry, manufacturing agricultural equipment.

However, as already indicated before, there are potentials to focus on data and features that can be considered rather as overhead functionalities than competition critical features. Joining efforts in developing related (open source) software services and sharing data could offer an added-value for all while being neutral, also not causing anti-competitive agreements.

Which existing platforms supported by ecosystems (at regional or national level) are already sharing data? In which sub-sectors are they sharing the data?

An example for such a strategy represents 365FarmNet that offers a service based FMIS, open for OEMs to provide their own services, while the famer specific master data can be used by all service providers as soon as the farmer is using a specific software service. At the same time, the FMIS is offering an open API that shall allow software developers like SMEs and startups to develop new services that could be offered via this or also other FMIS in a kind of marketplace driven infrastructure.

Here, an opportunity comes if a standard framework for sharing data is defined, not locked in to a particular FMIS vendor, based on adoption of a) an Open API for data exchange, b) common standard-based security mechanisms which can be integrated with the API, c) standard-based common data models. Again, the CEF/FIWARE Context Broker Building Block emerges as strong candidate for the first element and the definition of common smart data models for agri-food initiated in IoF2020 looks promising[2].

Public data sets of particular relevance for increasing the effectiveness of the Common European Agriculture Data Space?

The IoF2020 project was realising 33 use cases in diverse European regions, addressing the arable, dairy, fruit, meat, and vegetables sectors. These use cases are using diverse type of information models and related interfaces that are usually influenced by existing systems and related standards. Therefore, data models and relevant data sets are highly varying in the use cases. At the same time, public data sets are often rather national than European, or sectorial than relevant for the overall agri-food business domain.

The definition of "public data sets" possibly requires an additional clarification in terms of availability, costs and governance, since the current situation is characterised by general public data sets that are available to any anonymous entity, as well as data sets that are in principle public, but require registration, and/or membership or usage fees. This can be compared with the usual software terminology characterising open source, freeware, freemium, shareware, all connected to different business or operating models.

Nevertheless, as discussed with partners in IoF2020, a typical example for useful public data sets represents the access to registered fields in the cadastre systems of the governments. Such data could be used for e.g. providing automated tools for contractors. Specific examples of available public data sets are:

- Flanders
  http://www.geopunt.be/catalogus/datasetfolder/7cc9babc-e021-46bc-abb6-1b74d44b14ea
- Netherlands
  https://www.rvo.nl/onderwerpen/agrarisch-ondernemen/grond/percelen-registreren

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[2]   https://github.com/smart-data-models/dataModel.Agrifood/tree/master

Concerning additional data sets that might be relevant, one can potentially highlight data sets about product classifications/names/pictures, while this can characterise the produce itself, but also resources like pesticides. Moreover, it might be relevant to discuss, if public authorities could also have an interest to provide weather data as public data sets, facilitating agri-food processes as well as facilitating the provision of additional data to facilitate analysis with respect to climate change.

Experiences with taking public data sets as input to FMIS, farmers' applications or agricultural data spaces

The usage of public data sets is a basic prerequisite to provide e.g. features with respect to geoinformation or pesticide usage. When considering a multi-national or multi-lingual usage/offering of FMIS, system providers are confronted with data sets that are not uniform, not complete and/or not up-to-date. This causes by itself acceptance problems at the user side and hence a missing customer demand towards the FMIS providers. Furthermore, added value that can be generated by using specific data in a subsequent step of the supply chain, does not necessarily pay back to farmers that would need to invest in the installation of the FMIS and the continuous acquisition, management and publication of data.

This position paper is based on previous work in the IoF2020 project, analysing use cases from arable, dairy, fruit, meat, and vegetables sectors. Further information about the IoF2020 results is available via the IoF2020 website, listing all the report available to the public: https://www.iof2020.eu/about/deliverables

Experiences with creation of European data spaces where agricultural data is shared for creation of added value is limited. Therefore, we consider an impactful opportunity for the EC to activate funds for stimulating their development and piloting.

An additional summary with technology as well as interoperability related policy recommendations are presented in the IoF2020 report "D3.4 Policy Recommendations", publicly available for download via the Iof2020 website (https://www.iof2020.eu/deliverables/d3.4-policyrecommendations-final.pdf).