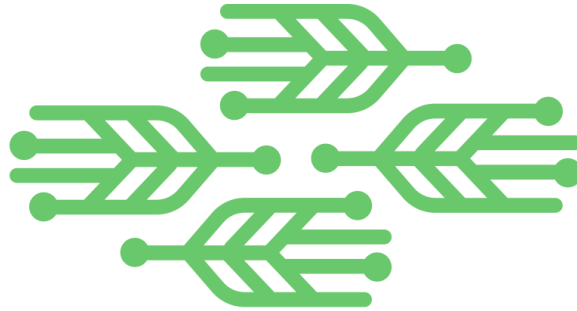


D3.3 Data Governance and Sustainability Strategy Recommendations Report



European Knowledge Repository for Best Agricultural Practices

TASK 3.5 Repository Governance and Sustainability Strategy

Summary

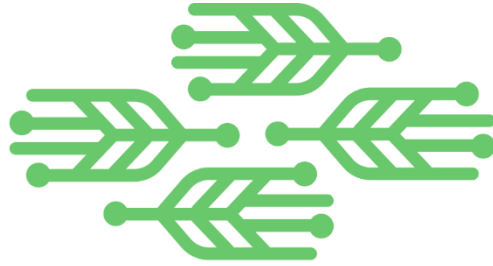
This report forms Deliverable 3.3 of the EUREKA project and concerns the description and analysis of the governance and sustainability aspects of the FarmBook.

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EUREKA



Table of Contents

| | |
|--|-----------|
| LIST OF FIGURES..... | 5 |
| LIST OF TABLES..... | 5 |
| LIST OF ABBREVIATIONS AND ACRONYMS..... | 6 |
| 1 OVERALL CONTEXT..... | 8 |
| 2 GOVERNANCE OF KNOWLEDGE OBJECTS..... | 9 |
| 2.1 ISSUES CONCERNING KNOWLEDGE OBJECTS | 10 |
| 2.1.1 OWNERSHIP OF RESEARCH OBJECTS | 11 |
| 2.1.2 CONTROL OF REUSE | 11 |
| 2.1.3 GDPR | 12 |
| 2.1.4 USERS' RIGHTS IN BUSINESS CONTEXT | 12 |
| 2.1.5 TARGET GROUPS REPRESENTATION AND NEEDS | 14 |
| 2.2 EXISTING GOVERNANCE PRINCIPLES AND APPROACHES OF KNOWLEDGE OBJECTS | 15 |
| 3 GOVERNANCE OF THE FARMBOOK..... | 17 |
| 4 SUSTAINABILITY AND THE CONTINUED AVAILABILITY OF THE EUREKA FARMBOOK..... | 17 |
| 4.1 RATIONALE | 17 |
| 4.2 EXISTING INITIATIVES FOR SUSTAINED AVAILABILITY OF PROJECT RESULTS | 18 |
| 4.3 ACTIONS NEEDED TO BRING THE FARMBOOK TO VALUE | 18 |
| 4.3.1 PERMANENT UPDATE OF KNOWLEDGE ITEMS TO REGIONAL CONTEXT AND NEW CONDITIONS | 20 |
| 4.3.2 CONTINUOUS ACQUISITION AND IMPROVEMENT | 20 |
| 4.4 BUSINESS MODELS | 20 |
| 4.5 PROPOSED FUNDING MODELS FOR SUSTAINABILITY | 22 |
| 4.6 GOVERNANCE STRUCTURE OF THE FUTURE FARMBOOK | 24 |
| 5 RECOMMENDATIONS..... | 25 |
| 6 CONCLUSION..... | 25 |
| REFERENCES..... | 26 |



List of figures

| | |
|--|----|
| Figure 1: Knowledge Objects in the overall context | 8 |
| Figure 2: Actions needed | 18 |
| Figure 3: Funding model | 22 |

List of tables

| | |
|--|----|
| Table 1: Supply chain partners and their TIS functions | 13 |
| Table 2: Target groups representation and needs | 14 |



List of abbreviations and acronyms

| | |
|----------|--|
| CORDIS | Community Research and Development Information Service |
| CSA | Coordination and Support Action |
| EC | European Commission |
| EIP-Agri | Agricultural European Innovation Partnership |
| EU | European Union |
| FG | Focus Group |
| HLEG | High-Level Expert Group |
| IA | Innovation Action |
| ICT | Information and Communications Technology |
| KR | Knowledge Reservoir |
| MAA | Multi-Actor Approach |
| MVE | Minimum Viable Ecosystem |
| PSI | Public Sector Information |
| OG | Operational Group |
| OSPP | Open Science Policy Platform |
| RIA | Research and Innovation Action |
| SAH | Smart Agri Hubs |
| TN | Thematic Network |
| TRL | Technology readiness level |
| WP | Work Package |
| GDPR | General Data Protection Regulation |



Executive Summary

This report forms Deliverable 3.3 of the EUREKA project and concerns the description and analysis of the governance and sustainability aspects of the FarmBook. Concerning governance of the FarmBook itself, the report finds that appropriate governance mechanisms and procedures are essential for the future uptake of the FarmBook, its acceptance by the community, and thus its eventual viability or sustainability. In the context of the EUREKA FarmBook, proper governance and the application of best practice in this area will provide confidence to current researchers, involved farmers, advisors, and other participants; and make the use of the FarmBook an attractive channel for distribution and storage of research outputs.

Concerning the governance of the knowledge objects which will be stored in the FarmBook, the report notes the importance of explicit permissions for use and suitable mechanisms to represent this. We recommend extensive use of the FAIR Data Principles in the technological design of the FarmBook to convey these explicit permissions. This also means that explicit permission both to include a knowledge object in the FarmBook as well as to allow third parties access would be the correct approach. Where relevant, GDPR rules need to be made more explicit and to be built into IoT devices and platforms which would also imply the greater use of the FAIR Data Principles. The creators of knowledge objects need to have the feeling that they retain control over their outputs and that mechanisms are in place to ask permission where and if necessary.

Concerning the sustainability and longer-term viability of the FarmBook, we propose that by drawing on multiple sources of funding for different areas in combination with the multi-actor approach for stakeholder engagement, a good foundation can be created for the FarmBook with a long-term future that remains adaptable to changing circumstances. However, in the short term, the FarmBook will be dependent on EC funding, and there are good arguments that this would be the best approach overall.



1 Overall Context

The Eureka Project seeks to bring together all research and other digital outputs from the large number of Multi-Actor Approach projects funded in the H2020 framework program in recent years. These outputs, or “knowledge objects”, include academic publications, reports, data sets, practice abstracts, and presentations. It is important to understand the role that such knowledge objects play in digitally-enabled research, development, and commercial practice in the agri-food sector.

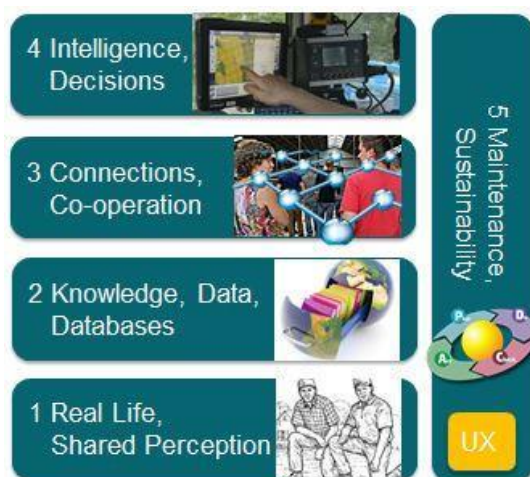


Figure 1: Knowledge Objects in the overall context

To make optimal decisions, based on knowledge (objects), the end-users should be provided with¹:

- *Intelligent* decision support (systems), that facilitate them to make a better decision than if they were without this information. An answer/suggestion/solution should be available timely, more precise, with more context, etc., than without the offered knowledge. An ICT system can provide this speed, precision, etc., but also simple paper forms, spreadsheet, etc., can bring this (layer 4)
- To make the solution specific, a connection must be made to data that are relevant in the context of the decision. The bottleneck in most solutions is *connectivity*, not only for technical reasons (protocols, standards) but mostly organizational human cooperation is hard to organize (layer 3)
- The knowledge (objects), should be *stored* in a FAIR way: Findable, Accessible, Interoperable, Reusable (layer 2)
- It should be linked to standardized *observation/virtualization* of the real (-time) processes that are relevant in the context of the decisions (layer 1)
- All this should have *sustained* availability as long as needed, so maintenance should be organized (layer 5)

¹ (Beulens, 2013) and <https://edepot.wur.nl/278631>

In this Deliverable, we highlight the governance aspects of these processes and the sustainability (enduring longevity) of the EUREKA FarmBook.

Sections 2 and 3 of this deliverable focus on governance. The governance concerns several issues that affect the EUREKA FarmBook and the knowledge objects that will be included. These issues include both aspects of the governance of the whole system (FarmBook) and the individual knowledge objects themselves.

Appropriate governance mechanisms and procedures are essential for the future uptake of the FarmBook, its acceptance by the community and thus its eventual viability or sustainability.

2 Governance of Knowledge Objects

The governance of research data has become more and more important in recent years. By "governance" here we mean issues concerning ownership or control of research outputs and research data, issues concerning who has access to these outputs and under what conditions, and issues concerning what third parties are allowed to do with any individual knowledge object. Research has gradually moved from the late 20th century for which only published papers counted as outputs, to a world where additional data, software, data models, and algorithms all can be considered distinct outputs. Therefore, the complexity of providing access, recognition, and appropriate controls has become more intricate.

While the 2000s saw a growing interest in the possibilities of "Open Data" and also "Linked Data", this was mostly confined to specific disciplines such as weather/climate prognosis, astronomy, and computer science. Much innovation has arisen from the needs and resources available in the Life Science community where specific challenges (such as patient health data), as well as opportunities (databases on protein sequences), have created contrary trends - one concerned with the protection of privacy, and the other with ensuring that any data used by a researcher can be reused and cross-checked by other researchers. This foundational work in the life Science community led to the development of the FAIR Data Principles². Within the EU, this movement has manifested itself in the European Open Science Cloud (EOSC) which consists of a series of initiatives to create a "pan-European federation of research data infrastructures."³ EOSC has fully adopted and subscribed to the FAIR Data Principles as well⁴.

The agri-food sector has had far less research funding than the Life Sciences or other industrial sectors until now, and also consists of many small players with fewer resources available to take the lead. The more recent growth of research projects in the broad area of agri-food has meant that there are far more papers published in recent years than 20 or 30 years ago. There has been a gradual awareness that it is not only papers but also other "knowledge objects" produced both by individual researchers and by funded research projects that have been

² Wilkinson et al. (2016) and <https://www.go-fair.org/>

³ <https://ec.europa.eu/research/openscience/index.cfm?pg=open-science-cloud>

⁴ European Commission Expert Group on FAIR Data (2018) EOSC Executive Board (2020)



produced. This has been more apparent in the basic research area (i.e. research on new crop varieties, GMOs, livestock breeding, etc.) which is naturally closer to the world of the Life Sciences, and only more recently is becoming an issue for other types of research (agricultural practices and paradigms, advisory services, precision agriculture/smart farming). There exist open data repositories for agricultural and related topics, but they are still far fewer than for the medical and health-related biological sciences (see <https://www.re3data.org>).

The funding of "Multi-actor" projects (MA) in recent years by the EC (specifically DG Agri) has broadened both the range and audience of the outputs of projects. Concurrently, the industry in collaboration with farmers representatives has taken the lead in trying to provide a "Code of Conduct" about the contracts and agreements to be put in place concerning the use of on-farm data by third parties⁵.

The Eureka project provides an opportunity to bring together the research outputs (knowledge objects) from a large number of heterogeneous projects. The project will develop and populate a "FarmBook" database including a large number of research outputs from many different types of projects. Careful consideration and recommendations concerning the manner of governance are needed for ethical reasons and to ensure that researchers and other participants in these MA projects have confidence that their work is recognised, that they still have control over how their work will be used or made available. Furthermore, as even greater investments will be made both in the EC and globally in agri-food research (cf. for example the new "Farm to Fork" initiatives within the Green New Deal funding), it has become imperative that research and innovation can build on pre-existing work, enable discovery of previous work and facilitate the reuse of datasets and other knowledge objects. This is true at every stage of research and innovation from the most basic to the highest technology readiness level (TRL).

In the context of the EUREKA FarmBook, proper governance and the application of best practice in this area will provide confidence to current researchers, involved farmers, advisors and other participants; and make the use of the FarmBook an attractive channel for distribution and storage of research outputs.

2.1 Issues concerning Knowledge Objects

Concerning governance of the digital objects or knowledge objects, several different aspects or issues need to be considered. In this section we discuss briefly each of these aspects and consider whether and how they impact the operation of the FarmBook. The FarmBook design is being heavily influenced by the FAIR Data Principles although these Data Principles cannot specify governance arrangements. The FAIR Data Principles can only express, some if not all, agreed arrangements.

While useful, knowledge of the FAIR Data Principles is not widespread. More effort is needed to make the abstract principles lively. In Eureka we designed a 'medieval allegory', where the impact of each principle on a farmer's and a researcher's question was discussed. <https://twitter.com/MariaGernert/status/1298964974585483265>

⁵ https://copa-cogeca.eu/img/user/files/EU%20CODE/EU_Code_2018_web_version.pdf



2.1.1 Ownership of research objects

The European Commission has required for several years “beneficiaries of research and innovation funding to make their publications available in open access and make their data as open as possible and as closed as necessary”⁶. There are some observations to be made here:

- Open access does not mean the absence of copyright. Consequently, any open access publications which FarmBook wants to include would need approval from the copyright owners for inclusion in the database.
- “Open access” publications usually refer to academic papers, while outputs of DG Agri MA Projects include a variety of items including presentations (slide decks), data sets, videos, and “practice abstracts”.
- Copyright is automatic but in research projects, there is often the implicit expectation that results, and other outputs are available for reuse by other researchers. However, an implicit expectation of reuse is not a legal concept and is frequently unclear or unknown because no one thought of specifying this.

Explicit permission both to include a knowledge object in the FarmBook as well as to allow third parties access would be the correct approach.

2.1.2 Control of reuse

Closely related to ownership is control of reuse. If we look at repositories by www.re3data.org which catalog the vast majority of EU open science data repositories, we observe that access to any individual data set is more often than not dependent on obtaining permission. There are clear access barriers even if these vary by subject area and the degree of openness of the culture in that community. Essentially, there is a need for balance for openness to be useful, and the need to respect ownership and knowledge objects. Furthermore, owners may want to specify different rules for different purposes e.g., scientific research vs. commercial or educational purposes. In some areas, even in agriculture, there is more concern about Intellectual Property (e.g., crop and livestock breeding) than in others. Previous work indicates even among scientists’ different purposes for the reuse of data leads to different behaviour, in some cases merely asking for data sets while in other cases preferring to establish a direct collaboration (Pasquetto et al., 2019). However, the FarmBook is intended for use by a wide variety of end-users, many of whom may not be used to the norms or habits of academic etiquette and thus may need more guidance or appropriate processes to specify what uses are permitted and where specific permission needs to be sought.

The European Commission in its Expert Group for FAIR Data supports the concept of “legal interoperability” for research objects and research data and that “Data creators and owners should opt for a waiver or license with minimum restrictions”⁷. This may be preferable for

⁶ https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy/open-science_en

⁷ European Commission Expert Group on FAIR Data (2018, p. 23)



research outputs but depending on the planned exploitation of results such an approach is unlikely to find favour immediately in the community. It might be appropriate to treat this as a medium-term aspiration.

The use of data of any sort coming from the agricultural sector is the focus of the COPA-COGECA and CEMA sponsored “Code of Conduct” (described below).

Explicit guidance needs to be given to ensure that knowledge objects have clear reuse specifications, that these are expressed in machine readable formats, and that end users are fully informed of the implications of the explicit reuse formulations.

2.1.3 GDPR

The relevance of EU’s General Data Protection Regulation⁸ (GDPR) to research outputs in agriculture and food is not yet widely understood. The widespread, uninformed, assumption has been that agricultural data does not concern individuals and thus falls outside the remit of this regulation. However, geolocation data is deemed personal even if it only concerns the characteristics of the soil on fields belonging to a farmer (Basu et al., 2020). The outputs of MA Projects funded by DG Agri can be assumed to a large extent not to include personal data relevant to GDPR. However, this cannot always be assumed, and care should be taken with any knowledge object where such issues might arise. Thus, reports or data sets concerning specific farm workers or employees, specifying social and other arrangements, or even when derived from sensors, may be subject to the GDPR. There is little literature on this interaction, although Wachter (Wachter, 2018) has considered these issues, specifically the tension between privacy and identifiability concerning IoT devices, but more from the perspective of actual commercial reuse of data rather than a research context. Wachter’s argues that “GDPR rules need to be made more explicit and to be built into IoT devices and platforms which would imply the greater use of the FAIR Data Principles”.

2.1.4 Users’ rights in a business context

At the end of the day, the innovation and research projects are there to be *used* to make farming practice more sustainable and viable.

The use of data is not a one-way connection between knowledge (object) provider and user: knowledge objects will be used, if different actors work together.

A linear model of a knowledge object in the supply chain can be defined as follows:

- a) Researchers publish their knowledge objects, their results of research projects.
- b) ICT companies define specific quests, they design pathways to solve them. They get access to the knowledge objects and *use* them to make their applications provide solutions.
- c) Advisors scan the market of possible solutions and select solutions for the specific situation of farmers.

⁸ EU 2016/679 <https://eur-lex.europa.eu/eli/reg/2016/679/oj> and https://ec.europa.eu/info/law/law-topic/data-protection_en



- d) Suppliers provide the tools and supplies to materialize the solution/advice.
- e) Farmers combine the knowledge and invest in solutions/innovations.
- f) Processors and traders create a market for the innovative products, they pay for them.
- g) Policymakers create the conditions in which a fair market development is possible.

A more interactive model on innovation is the Technical Innovation System Analysis (TIS)⁹: this focuses on actors working together on innovation functions:

- 1 Knowledge development, through studies, laboratory experiments, pilots, and communities of practice.
- 2 Giving direction to the search process, by 'managing' expectations, promises, policy objectives.
- 3 Knowledge diffusion in networks, e.g., through conferences, workshops, alliances, communities of practice.
- 4 Experimentation by entrepreneurs, with commercial projects, demonstration projects, portfolio expansions.
- 5 Creation of markets, e.g., through market stimulation policies, tax exemptions.
- 6 Mobilising resources, e.g., in the form of grants, venture capital, investments.
- 7 Creating legitimacy through lobbying activities, advice, etc.

So specific combinations of users are always at stake in the uptake of knowledge. The table below shows how the supply chain actors can be involved in the TIS functions.

Table 1: Supply chain partners and their TIS functions

| Function | Chain partners | | | | | | | |
|-----------------------------------|----------------|-----|--------|--------|--------|-------|--------|--|
| | Research | ICT | Advice | Supply | Farmer | Trade | Policy | |
| Knowledge device? | x | | | | | | | |
| Direction search | | | | | | | x | |
| Dissemination | | | x | | | | | |
| Entrepreneurship | | x | | x | x | x | | |
| Market creation | | | | x | | x | | |
| Mobilise resources | | | | Org* | Org | Org | x | |
| Create legitimacy | | Org | | Org | Org | Org | | |
| (*Org = organisation/association) | | | | | | | | |

If actors give a positive push in some functions at the same time, an 'innovation motor' starts turning. So, if a researcher gives relevant results for policy, the policy officer may expand the funding for future research (knowledge wheel). Or if entrepreneurs see chances, they will start experimenting (entrepreneurial wheel), mobilise more resources and develop markets (market wheel). *For each Technological Innovation System function, the users have to find an appropriate balance in the rights of stakeholders. These users' and developers' rights are determined in the market and project networks.* These networks create the conditions to implement the knowledge objects, but they also have to deal with - often unexpected - conditions that block implementation: you can get the horse to the water, but you cannot

⁹ Hekkert et al., (2007), <https://www.sciencedirect.com/science/article/pii/S0040162506000564>



make it drink. Entrepreneurial groups of stakeholders should finetune the availability of data to the specific circumstances.

2.1.5 Target groups representation and needs

Several organisations represent different categories of stakeholders. Potential end-users of knowledge objects in the FarmBook should try to discuss regulations and allotment of resources with these organisations of farmers, supply, trade, and ICT developers on one hand and policymakers on the other. In these networks the researchers and advisors usually but not only play a facilitating role.

Table 2: Target groups representation and needs

| Target Groups | Organisations | Needs: information that supports... |
|---------------------------------|--|---|
| Policy | EC, ScarAKIS | Sustainability, rural welfare |
| Farmers' organisations & coops | Copa-Cogeca, CEJA, IFOAM | Future for the farmers |
| Trade/processors' organisations | Food Europe, FEFAC | Reliable agrarian products that match to consumer's needs |
| Suppliers organisations | CEETAR, Euroseeds, ECPA, EFFAB, Fertilizers Europe | Innovative products for farmers |
| ICT developers/industry | CEMA. Manufacture | Innovative systems for farming |
| Advisors / AKIS | EufRAS | Optimum uptake and impact of information |
| Researchers | Leading Universities and Institutions | Optimum use and quotation of their published research |

The need of policymakers is to have elements to create an overview over relevant developments in practice or find good practices to illustrate the feasibility of policy interventions on sustainability, productivity, rural welfare.

Farmers' organisations and coops have the same needs for their lobby work, and at the same time connect initiatives of members to bring the sector to a higher level, to create a sustainable future.

Trade and processors can be partners in innovation, at the end on their behalf: to get reliable agrarian products that match consumer's needs.

Agrarian suppliers and their organisations share the challenge to create the best products for farmers, their need is to find partners in innovation and users of their products.

ICT sector, just like other suppliers, is a key stakeholder in innovation, it comes with products in a fast-evolving market and needs to find ways to link optimally to the farmers that appreciate innovations, by co-creation, dissemination, and integration, so that the new products are effective and easy to implement.

Advisors and other actors in AKIS need to be regularly informed on the newest products and developments so that they can disseminate a wide range of developed techniques and facilitate co-creation.



Researchers or innovators planning new research, new dissemination or some kind of commercial product have a need or would be well advised to discuss their plans with the appropriate or relevant subset of the above actors, so as to take into account their advice and needs in the reuse of knowledge outputs.

2.2 Existing governance principles and approaches of knowledge objects

There exist several relevant approaches and collections of principles that are important in setting the scene for the context in which the FarmBook will operate. Substantial changes have occurred in the agri-food sector in the past ten years and influences and ideas have come from multiple directions. Here we briefly describe some of the most significant:

Code of Conduct for Agricultural Data Sharing by Contractual Agreement (CoC)

The CoC (Copa-Cogeca et al., 2018) has been designed, given the growth of “digitally enhanced farming”, to clarify roles and responsibilities when sharing data coming from instruments on the farm. The Code recognises that data has become or is becoming valuable, and that suitable principles are necessary to protect the farmer when several different providers or services are involved in modern precision agriculture. The CoC defines data user rights (instead of 'data ownership') as core and assigns the rights of the data originator (instead of 'owner'): the one that creates/collects the data themselves, via technique or commissioned providers. This Code recognises the data originator’s right, whether they are a farmer or another party, to benefit from and/or be compensated for the use of data created as part of their activity.

The code of conduct was designed to clarify rights and responsibilities regarding agricultural data to encourage farmers to trust that sharing data would be to their benefit. Academic analysis suggests the CoC does not go far enough, as yet, in protecting farmers and ensuring full transparency about the uses that can be made of data (van der Burg et al., 2020). A new version of the Code is under development and might be available within the lifetime of the Eureka project.

European Open Science Cloud (EOSC)

The main purpose of European Open Science Cloud (EOSC <https://www.eosc-portal.eu/>) is to give Europe a global scientific data infrastructure and to ensure that European Scientists take advantage of data-driven science¹⁰. EOSC aims to provide a trusted and open environment for the scientific community for storing, sharing, and re-using scientific data and results. This is supported by high-capacity cloud solutions with super-computing capacity under structured governance, defined rules of participation, and a structured business model. One of the key objectives of EOSC is to effectively link people, data, services, training, publications, projects, and organizations across borders and scientific disciplines based on the concept of Minimal Viable Ecosystem.

Currently, EOSC is operating from a very heterogeneous e-infrastructures landscape provided by various service providers. EOSC is dependent on EU Member States for their e-

¹⁰ See the EOSC Declaration https://eosc-portal.eu/sites/default/files/eosc_declaration.pdf and also https://ec.europa.eu/research/openscience/pdf/eosc_strategic_implementation_roadmap_large.pdf



infrastructures and its users are from a wide range of disciplines. This creates the challenge for developing a standard e-infrastructure, governance structure, and engagement rules. To address this challenge EOSC is working on a Minimum Viable Ecosystem (MVE) for its affiliated e-infrastructures. 2nd High-Level Expert Group (HLEG) EOSC is coordinating with the Member States to develop consensus on basic technical, political and human resources conditions that should be met while developing or affiliating e-infrastructures.

Presently, the free flow of non-personal data and proposed activities by EOSC complies with the current EU legal framework and Member State laws and takes into account changes that might occur in the future. The 2nd HLEG EOSC is in the process of preparing rules relating to data localization requirements based on the EC's public consultation review of the Public Sector Information (PSI Directive). 2nd HLEG EOSC will define the rules of participation including rights, obligations, and accountability of those involved from EOSC. These include data producers, service providers, data/service users, and potential applicable legal frameworks (e.g. General Data Protection Regulation (GDPR), copyright rules, Data Security and Cybercrime, dispute resolution and redress mechanisms, e-commerce directive). Although the 2nd HLEG EOSC is working independently, they also interact frequently with FAIR and Open Science Policy Platform (OSPP) expert groups initiated by the European Commission. EOSC consolidates findings of the FAIR data principles and Open Science research data management into EOSC implementation strategies and e-infrastructure standardizations.

Under the MVE, data quality and data security are the most difficult elements to standardize because the nature and purpose of participation vary so much across EOSC users. In this situation, FAIR principles play a crucial role by defining an appropriate standard for metadata that should be efficiently defined by data depositors and implemented by repositories and index services. Data that is part of EOSC and distributed that way has different levels of access control depending on intellectual property (IP) issues, embargoes before publication, and personal data-protection considerations. In some cases where data have national security implications, additional levels of access control are required. To resolve this concern, EOSC ensures that access control remains with the entity that is ultimately legally responsible for ensuring that the data is properly restricted.

Currently, European researchers, developers, service providers, and infrastructure managers are structured in small or large teams based around European institutions, research centers, and companies. The engagement of these users or service providers heavily depends on the rules of participation. Apart from explicit rules of participation, one of its key objectives that EOSC is trying to create is the relationships of trust with its users.

The governance of EOSC is quite complex as it depends on engagement at government level of the EU member states, and depends on a board appointed at ministerial level. This ensures political commitment from EU countries but is obviously not easily replicable for a narrowly defined project like the EUREKA FarmBook.



3 Governance of the FarmBook

The FarmBook will collect digital objects (“knowledge objects”) from across the spectrum of research projects related to agriculture and forestry, even if the primary sources will be existing DG Agri funded MAA projects. The FarmBook will provide a service to the community, but such a platform, to gain acceptance and trust, needs clear governance structures and mechanisms. Clarity and transparency as well as stakeholder engagement are essential if the FarmBook hopes to become “the place” for knowledge objects to be found and deposited. As the FarmBook grows (hopefully) the data and knowledge objects amassed will become more interesting, more valuable, and sensitive data (or data that renders one or more stakeholders uncomfortable) will be potentially become more available. Here again, clear governance and responsibility are essential.

In the context of the Food Integrity project, which addresses the issues of safety, authenticity, and quality of European food and emphasizes integrating research and technology for ensuring the integrity of European food, a Delphi study was undertaken concerning what type of agency food industry players would be comfortable with, when controlling a data-sharing platform. Among a range of possible options including a government agency and a private company, an independent foundation or association was found to be the most acceptable due to issues of business confidentiality (Minnens et al., 2019). While such concerns are not obvious in the context of MAA projects and their outputs, such ideas should be taken into account when designing the FarmBook governance for the long term.

The most obvious governance structures are either a) an association or foundation or b) continued ownership and control directly by the EC through for example DG Research or DG Agri. Either way, a board would need to be appointed which would have ultimate control and responsibility for the platform and the contents. Furthermore, because of the developing relationships with the whole range of initiatives that exist to share data including EOSC, it would be important to have an advisory board made up of leading actors from the various international and national research data sharing projects.

4 Sustainability and the continued availability of the Eureka FarmBook

4.1 Rationale

The intention of the European Commission, as well as the widely expressed desire of a variety of stakeholder groups, is that the data, tools, and insights from MAA projects should remain available indefinitely. This is because these results are important a) as records of previous activities, experiments, and results; b) as scientific foundations for the development of further research and innovation; and c) because these results are an important resource for all stakeholders to inform their daily decisions and practices.

In the context of the Eureka project, FarmBook is a facilitator for the conservation of results. Suitable plans need to be made to ensure that both the data collected as well as the



infrastructure continue to remain available, accessible and usable to end-users. Due to the heterogeneity of the different results that are being brought together, the FarmBook and the ecosystem around it should be a foundation for further development. However, the FarmBook does not stand alone, as it is only with the continuing input from public and/or private partners who see the value of it that the FarmBook will continue to be enriched with the content and used in practice.

4.2 Existing initiatives for sustained availability of project results

The FarmBook will be additional and complementary to the project-specific sites, where most H2020 projects publish their results. However, such sites are usually kept alive for only a few years after a project closes. For conventional research publications including certain types of data sets, the publishing and preservation are well organised by existing publishers or by new platforms developed as a result of the open science policy of the EC. Furthermore, information of all EC projects is published on CORDIS and Multi Actor Projects can use publication/brokerage facilities of EIP-Agri for their descriptions and Practice Abstracts.

Some projects have developed common platforms where the continued availability of their research outputs is assured, for instance:

- ask-Valerie (<https://www.ask-valerie.eu/>): developed in the Valerie project, re-used in Fairshare.
- Biorefine cluster: (<https://www.biorefine.eu/>): (26 active and 28 finished projects), some of them use this cluster site instead of building their network. The cluster site has as one of its objectives to “extend the lifespan of deliverables after a project ends”.
- IoT-catalogue.com, which is developed under IoF2020.eu but designed to continue for years. This, however, is mostly a catalogue of IoT devices and services relevant to the agriculture domain.
- The Innovation portal of smartagrihubs.eu (<https://www.smartagrihubs.eu/portal>): components of it are exchanged by IoF2020.eu and Agrobofood.eu. However, this is mostly focused on community engagement, reporting events, training, and presenting organisations rather than knowledge objects.
- The Enabling Project’s Best Practice Atlas (<https://atlasbestpractices.com/>), provides Practice Abstracts for Bio-based Products and Processes and its repository is used also in other projects.
- The Organic Farm Knowledge platform (<https://organic-farmknowledge.org/>) built by the OK-NET Arable and OK-NET Feed projects, provides a database focussed on the organic sectors.

All these examples are restricted or limited in some way. They largely ignore the developments in FAIR Data Principles and mostly focus on either Practice Abstracts or conventional academic research publications.

4.3 Actions needed to bring the FarmBook to value

The ultimate aim of the FarmBook is to make project results available to the target groups, make these results easy to find, and ensure their continuing availability for a long time, with a consistent interface, and with understandable procedures.

To make this possible, 4 groups of actions can be distinguished, we describe them below.



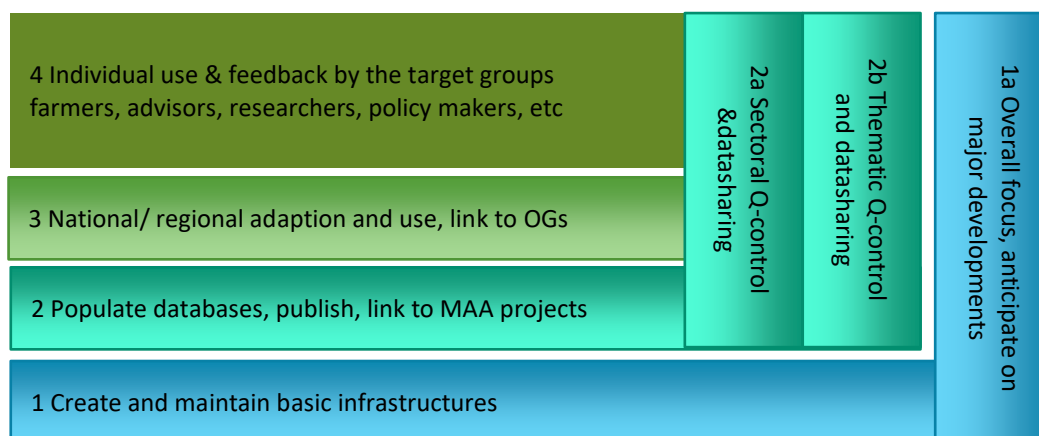


Figure 2: Actions needed

1. Create and maintain basic infrastructures: The design, layout, coding, development, etc. of the FarmBook should be done with the latest standards so that the complete process from adding knowledge objects, addition, to effective use is supported optimally and flexibly.
2. Populate the database, publish, link to existing MAA projects: It is and will continue to be a challenge to get EU financed Multi Actor Approach (MAA) projects' outputs into a central repository. For this reason, a 2-way approach is recommended: a platform to publish and organize results easily and optimally (the carrot) and some pressure on the project requirements (the stick). It will be an even bigger challenge to get information from other sources (i.e., not MAA projects). For that, it will be necessary that the FarmBook is 'the place to be' if you want to show that you are innovative. Stakeholders can be passionate about a certain topic and this energy can be activated by:
 - a. A sectoral (dairy, arable, beef, etc.) approach to control the quality of the data and organize data sharing.
 - b. A thematic approach, where knowledge on important developments (chosen in 1a) is collected, organized, visualized, and disclosed. Often these themes should be addressed over sectors.
3. National/ regional adoption and use, link to OGs: After a central database is populated, there is a need to adapt the output of the FarmBook to the many local circumstances in Europe: translation, collection of experiences in a specific region, the adaption of selected solutions for challenges are keys for the success of the FarmBook.
4. Individual use and feedback by the target groups. The aim of the FarmBook is that farmers, advisors, researchers, policymakers, etc. will take advantage of the available knowledge. The needs of those target groups change at an ever-increasing speed, so it's crucial to have permanent feedback from stakeholders. In this way, optimal use of the knowledge is guaranteed.

With a multi-level and multi actor approach, a good basis can be created to sustain the FarmBook and adapt it permanently to circumstances. The next paragraphs elaborate about this more in depth.

4.3.1 Permanent update of knowledge items to the regional context and new conditions

Soon, computers will develop language processing capabilities that will make it possible to present texts in any language. It may even be possible to make a correct conversion of local language concepts and sayings to other regions. Until that time selected texts need to be translated, to connect to the target groups that don't speak English natively.

Text is only 20% of what people learn from. Visual media (movies, infographics, mind maps, etc) increase the impact of knowledge presented significantly. The FarmBook should make it easy to access and to upload such knowledge objects. Furthermore, incentives will be needed for contributors to provide (audio-)visual material. In the total development of the FarmBook, there is a permanent focus on new trends, new presentation styles, so that they are ready when stakeholders start to appreciate them.

4.3.2 Continuous acquisition and improvement

To ensure that the FarmBook is considered the best place to find and publish project outputs, the database will need to be continuously kept up to date by the addition of new material. The Practice Abstracts (PAs) in the EIP-AGRI database have a straightforward workflow. All MAA projects deliver PAs. However, currently finding PAs is challenging within the EIP-Agri search functionalities. In Eureka and any follow-on projects, far better ways to query the database needs to be made available, allowing users to focus precisely on their requirements.

The FarmBook provides a starting point for knowledge object acquisition tools that will facilitate project partners to deliver content easily. Above all such facilities should trigger project partners and others to deliver their knowledge objects and thus ensure the dataset remains the largest and most complete possible.

An important trigger is rewarding contributions. The most powerful reward is recognition by the end-user. Reward systems are needed, already known through social media, to translate appreciation of different end-users into positive feedback to the knowledge providers. This will help incentivise people to upload content.

Automated ICT supported knowledge acquisition is not enough to make sure that the FarmBook will have a rich collection of up-to-date knowledge objects. An infrastructure, including training and networking, needs to be developed to create a community of knowledge-sharing people. This community will be diverse: farmers, advisors, researchers, teachers, students, policymakers, yet who all share a common mission: to jointly generate the best knowledge to foster innovation.

4.4 Business models

To fund or finance the sustained availability and further development of a FarmBook, different finance/business models are possible. Here, we reflect on some major types:



Public Funding:

Ensuring the (re)use of knowledge generated in publicly funded project is an important reason to spend public money on making the FarmBook more permanently available. Different sources could be considered:

- **EU Horizon 2020/Europe research money:** In essence, the FarmBook platform is designed to increase the impact of H2020/Horizon Europe investments, so it would make sense to allocate a structural budget for governance and administration, basic infrastructure and data acquisition, and data management. Data acquisition can be done much more cost-effective if the projects are obliged to deliver information in a certain format, just like the EIP Practice Abstracts are submitted now. The REA contracting structure is a very suitable vehicle to include such obligations.
- **EU Thematic funding:** When policy targets are set, then the action plan creates prerequisites for related knowledge generation and exchange. The FarmBook, including all the existing knowledge and experience items, could be a **strong** tool for this, and thus an extra investment for such a tool would make sense.
- **National/regional funding:** Member States invest in their National Contact Points, to enhance knowledge exchange and collaboration between EIP Operational Groups and innovation initiatives in other programmes. This information is, of course, in their national language and linked to national/local circumstances. For NCPs, it is interesting to translate knowledge objects from the FarmBook, rather than developing new material. At the same time, NCPs can increase outreach and enhance international cooperation, when they share information of their groups in the FarmBook. Within each EU planning period, a new task description is agreed on for the NCPs, so at this moment there is a unique chance to organise the interaction with FarmBook platform.

Private funding and support:

Private input could be in cash, with different arrangements, but equally important is private input in kind.

- **Cash input from farmers and advisors:** The information in the FarmBook could contribute to better choices in innovation and daily management. The payment of the information can be organised in arrangements, like a subscription to the information, pay-per-view, etc.
A problem with this approach is that while the information is valuable, the value is only realised, when a farmer uses a solution from the information. Therefore, it is not easy to convince farmers to pay a price for entry to the FarmBook, even with easy entry models like freemium accounts. Furthermore, it is even harder to set a price, because Google gives a lot of information 'for free'. The same is true when we want to price entry for advisors, they have to calculate this input to their clients.
- **Cash input from agribusiness:** Agribusiness could pay for advertisements or advertorials, separately per item or in 'packages' that include some advertisements, free entry, information links etc. To organise this, a dedicated team would need to work on it, or to be subcontracted.
- **In kind input:** Without paying money, the farmers, advisors, and companies can make substantial contributions to the FarmBook, in other ways: they can upload information (experiences) 'from the grassroots', add information to existing knowledge items ('from answers to solutions'). And they can give feedback: explicitly (with reactions/remarks, ratings, acknowledgments) or implicitly (from the users' statistics). To capture these user-information sources, the FarmBook must provide a digital



platform in a way that is open for interaction. However, such an open platform will also require resources to be dedicated to monitoring to avoid abuse.

- **Charity or Foundation based support:** Major agricultural research institutions such as the CGIAR network depend on large proportions of their funding from large charities (e.g. Gates Foundation). Such a model would depend on the FarmBook having a separate legal existence and for there to be sufficient interest from a variety of potential contributors for the medium to long-term funding model to be viable.
- **3rd Party function sharing:** As discussed above, the FarmBook operates in an ecosystem of knowledge platforms. Information in other platforms is often specialised with the possibility to dig deeper. In such cases, it may be more effective to make deep links between the platform and the FarmBook. For other initiatives, it may be more interesting to make a specialised front end and specific input area in the FarmBook, instead of designing a new platform.

In these descriptions, we see advantages and dangers in each business/finance model. In general, a danger of a private-funded FarmBook would be a fight on open access, and a repetition of the unwanted developments in scientific publication, that are now addressed in the Open Science Cloud. The private sector is likely to be only interested in knowledge objects of relevance to their short-term interests rather than, for example, the kind of deeper transformation envisaged by the Green Deal and necessitated by wider scientific research. Concerning ‘practice publication’, we now have the chance to organise it well from the start. One danger of purely public funding is the limited involvement of the final target groups in the farmers’ ecosystem. A solution for this via pricing may not generate enough income or maybe too costly.

An approach that seeks to involve the target groups with explicit or implicit contributions, is expected to have the best chance on success. 3rd party function sharing may be technically complex, but it can offer interesting advantages if implemented well.

4.5 Proposed funding models for sustainability

There are several dimensions to ensuring the continued sustainability of the FarmBook. The primary aspects concern core funding and keeping the database up to date. Following the model shown in Figure 2, here we propose a mixed funding approach which reflects the fact that different funding models may be suitable for different aspects or dimensions of the overall FarmBook.



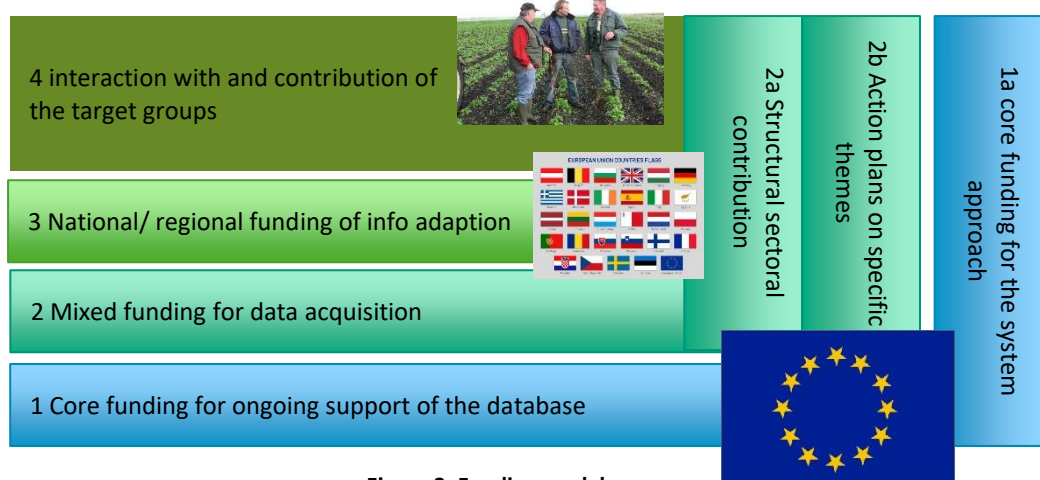


Figure 3: Funding model

1. **Core funding for the ongoing support of the database and the system.** Core funding for the ongoing support of the database and the system needs to be provided by the European Commission or a similar entity. Funding with Horizon Europe makes sense but has a limited horizon, so this does solve the long-term resource issue entirely¹¹.
2. **Mixed funding for data acquisition.** Another aspect concerns keeping the database up to date, whenever projects generate results. Funding of this process will be provided in the EC Funded projects (depending on an explicit obligation being included in future contracts), with complementary financing of the organisation that acquires the knowledge items. For sectoral and thematic quality control and data sharing specific funding should be provided, to the urgency of the chosen themes. On the sectoral level, internationally focused knowledge quality assessment and dissemination, inside and outside Europe. Finance is generated on the level where the themes are seen as relevant.
3. **National/regional funding of Knowledge Object collection and adaption.** This mainly concerns ensuring that content is available in the languages of the respective nations in the EU, as well as local data and knowledge object collection. Here we would like to see more engagement at a national level, both to facilitate the data collection, and also to (ideally) provide national language versions of the outputs or at least the most important outputs that reside in the database. It might be possible to develop a strategy centred on National Contact Points, or around the Rural Development Programme (RnDP) or other such initiatives that can enable strong links with local end-users.
4. **Interaction with and contribution of the target groups.** For transnational projects, in order for the database to be up to date, all projects should be contractually obliged to upload their outputs to the FarmBook together with appropriate metadata. A suitable human interface needs to be available as well as API access.

The financial requirements should be provided according to the development phases: starting from the core infrastructure and organisation, then putting permanent effort into data acquisition, and finally developing new possibilities of national adaptation to user input.

¹¹ We are aware that a call topic relevant to this HORIZON-CL6-AKI-2021-00-00: ‘Supporting knowledge exchange between all AKIS actors in the Member States by means of an EU-wide interactive knowledge reservoir’ has been included in plans for Horizon Europe. This is of course to be welcomed.

4.6 The governance structure of the future FarmBook

Multi-input (national/regional; sectoral; thematic) should be combined with multi-stakeholder governance: the most contributing partners should be awarded a 'seat on the table'. This can be organised on different levels:

- A central committee with the technical and ecosystem experts and a general manager.
- General assembly with 3 major stakeholders/country (farmer representatives, research, industry, agencies).
- National committees, linked to/ organized by the National Contact Points.
- Sectoral soundboards, in charge of quality control and detecting new developments.
- Thematic action groups, making and executing action plans for new urgent themes.

Finally, the results of funded projects should be made available for practice (different levels/worlds, including policy) and future research. Practical steering matches to organise this focus on the uptake of the use by the community: the more use, appreciation, and importance generate more use, etc. The structure is fitting to the needs at a specific moment if it creates this upwards movement.

Different actors in the proposed governance structure need to have a shared roadmap and milestones to agree if they are on track to create impact. EURAKNOS¹² suggested the following impact indicators to evaluate the probability of impact of the Knowledge Reservoir Platform:

- TN content: number of key disciplines involved during the project's life cycle; easily understandable language, terminology oriented to practitioners; the number of materials produced with practice-oriented content; availability of content in a range of languages
- TN content storage: number of user-friendly functionalities; user analytics; the number of linkages with social media; budget for the website after the lifespan of the project; the number of months that the website is available after the project lifespan; the number of linkages to external data repositories; compatibility with the FAIR data principles; open-access; end-users' usage of TN outputs per period (e.g. classical citation)
- TN C&D: number of training modules; the number of local languages in which TN outputs are produced; the number of events organised, newsletters produced, target audience reached, number of hits on the website, etc.; interactive publication list which counts the number of downloads for each material; the number of webinars
- TN MAA: number of key actors involved; equal distribution between actors from different European regions; equal representation of different fields of expertise and sectors.

In the end, the aim of this suggested structure and dimensions for KPIs is to facilitate the permanent optimisation of a Farmbook, so that it is well appreciated and frequently used by the end-users.

¹² Gernert, Moeskops et al, Euraknos D4.1 Added value and feasibility e-KRP, based on Studnitz et al. „Summary on current practices and methodologies of TNs, 2020, and mind mapping by EURAKNOS partners

5 Recommendations

In summary here we provide the basic core recommendations to come out of this report:

- Full use needs to be made of the FAIR data principles and associated technologies to make knowledge objects in the FarmBook as explicitly labelled as possible when it comes to matters concerning ownership and reuse.
- Future funded research projects should have a contractual obligation to upload knowledge objects (outputs) to the FarmBook. Only in this manner can there be any long-term assurance that the database will be up to date.
- An advisory board of European organisations to foster the use of knowledge objects from European data sources like Eureka, Euraknos, SAH should be set up.
- The longer-term sustainability of the FarmBook needs to be assured and an appropriate funding model (out of those discussed or others) must be found. Initially, the FarmBook continues to need funding from the EC directly.

6 Conclusion

In this report we have sought to delineate the issues which arise for the FarmBook, currently being developed in the Eureka project regarding governance and sustainability beyond the life of the project. We have identified issues concerning the governance of individual knowledge objects and recommended full use of the FAIR data principles to make as explicit as possible access and usage rights and limitations. We have also noted that the FarmBook as whole needs clear governance with the involvement of the wider community it intended to serve to ensure engagement and trust from that community.

Concerning the sustainability of the FarmBook, we have considered a variety of business models for its future financial viability. We noted the importance of good governance as well as ensuring longevity and viability. From a funding perspective, we proposed a multi-dimensional approach that would seek funding for different layers/dimensions of the FarmBook from different stakeholders. However, it should be stressed that as the FarmBook arises from EC-funded project outputs and is aimed at supporting agriculture across the EC, we would find a funding model that continues to draw the majority of its resources from the EC budget to be the simplest and most effective.



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