D3.1 Data Selection and Data Quality Assessment Report



EUREKA

European Knowledge Repository for Best Agricultural Practices



TASK 3.1 and 3.2 Evaluation and selection of data sets and knowledge objects and Data Quality Evaluation

Summary

Deliverable 3.1 of the EUREKA project concerns the results of Task 3.1 Evaluation and selection of data sets and knowledge objects and Task 3.2 Data Quality Evaluation. Task 3.1 looked at the outputs from WP1, in particular the list of MA projects and knowledge objects and end-user evaluation criteria from WP2, to analyse the data sets available and the end-user needs for selecting data and knowledge objects to be included in the EU FarmBook. Task 3.2 evaluated the FAIRness of data (as defined originally in Wilkinson et al. 2016), especially concerning the metadata descriptors of the data.

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List of abbreviations and acronyms

ЗАРТА	3A Parco Tecnologico Agroalimentare dell'Umbria
МА	Multi Actor
MAPs	Multi-Actor Projects
WP	Work Package
FAIR	Findable Accessible Interoperable Reusable
PID	Persistent Identifiers
CTS	CoreTrustSeal
EC	European Commission
FG	Focus Group
EIP-AGRI	European Innovation Partnership for Agriculture
ODRL	Open Digital Rights Language
FRAPO	Funding, Research Administration and Projects Ontology
RDF	Resource Description Framework
OWL	Ontology Web Language





Executive summary

This report is the Deliverable 3.1 of the EUREKA project. We have achieved two objectives under this deliverable: 1) selecting data sets and knowledge objects, and 2) data quality evaluation of knowledge objects from selected Multi-Actor projects (MAPs) based on FAIR data principles.

To finalise the data sets and knowledge objects for EUREKA EU FarmBook, we planned several tasks. The first task of this deliverable was to review the findings of the WP1 (i.e., ranked list of MA projects and knowledge objects) and WP2 (i.e., end-user evaluation criteria). Based on this review, the draft list of potential knowledge objects was made for the EUREKA EU FarmBook. At the same time, the end-user needs were also taken into consideration. A further assessment was carried out based on the insights of domain experts and potential end-users in the workshop setting to finalise the selection of knowledge objects and end-user needs. Five thematic working groups were formed by experts specialised in different sectors and areas: 1) Arable and horticulture crops, 2) Perennial crops, 3) Forestry, 4) Livestock and Dairy 5) Industrial crops and Agrifood Industry. Within each thematic working group, the recruitment of experts was carried out across the EU. After the selection and invitation of experts, five webinars were organised. These webinars aimed to discuss the draft selection of knowledge objects and end-user needs were organised with the domain experts and finalise a priority ranking of the knowledge objects and end-user needs for EUREKA EU FarmBook.

The second task of this deliverable was measuring the quality of knowledge objects from selected Multi-Actor projects (MAPs). We developed a FAIRness assessment framework based on FAIR data principles. We carried out a literature review of the FAIR data principles, FAIR assessment tools, and case studies across multiple knowledge domains. The literature review helped us to identify data quality characteristics and scoring systems to measure the FAIRness of knowledge objects needed for EUREKA EU FarmBook. The FAIRness assessment findings showed that only about 22% of the knowledge objects meet the FAIR principles requirement. Based on the FAIRness score for the selected MAPs and knowledge objects, a set of recommendations have been proposed to improve quality and FAIRness of the knowledge objects. The recommendations provided in Deliverable 3.1 have implications for the design of EUREKA EU FarmBook FAIR repository.





1 Objective of Task 3.1 Evaluation and selection of data sets and knowledge objects

The present report documents the work undertaken in the context of Tasks 3.1 ("Evaluation and selection of data sets and knowledge objects") and 3.2 ("Data Quality Evaluation") of EUREKA. More precisely, the report reflects on the following activities:

- Analysis of the outcomes of WP1 (list of MA projects and knowledge objects) and WP2 (end-user requirements) in order to select data and knowledge objects to include in the EU FarmBook.
- 2. Creation of five thematic working groups, selection of thematic, domain experts, and design and delivery of online webinars.
- 3. Evaluation of data quality based on FAIR data principles.

The overall methodology that has served as the basis for executing the respective tasks and activities is outlined in Section 2.

As a general remark, the work carried out in WP1 and the results obtained from the regional workshops of WP2, have also provided significant inputs for this report.

Given the above, the reporting of the activities and results in the present document is made on the basis of the following structure. At first, the methodology will be outlined. The methodology section involves:

- 1. The assessment of the work undertaken in WP1 and WP2;
- 2. The Creation of thematic Working Groups and the selection of thematic domain experts;
- 3. Planning, preparation, and organisation of the thematic webinars.

Section 4 shows the findings and learnings from the thematic working webinars. Section 5,6,7, and 8 deal with the data quality evaluation and FAIRness assessment process. The results section shows the data quality of knowledge objects and the overall FAIRness of the selected knowledge objects and MAPs. The final section presents the proposed recommendations for the compliance of the FAIR principles within the EUREKA EU FarmBook.





2 Workflow and methodology

Figure 1 shows the workflow of the activities carried out in Task 3.1.



Figure 1: Conceptual workflow

The **first step** in this task was the assessment of the outputs from WP1 and WP2.

In WP1, 101 MA projects were mapped and those screening results, together with the results from WP2, were used to determine which data to be further examined so to create inputs for the assessment activity to be done in the thematic working groups.

Then, in order to organise the qualitative and quantitative assessment of the data sets and receive a feedback on what knowledge objects to be included in the EU FarmBook, the **second step** was performed: the creation of the 5 thematic working groups formed by experts specialized in different sectors and areas, namely: (1) Arable and Horticulture Crops, 2) Perennial Crops, 3) Forestry, 4) Livestock and Dairy and 5) Industrial Crops and Agri-food Industry. The recruitment of experts was the most challenging and complex activity considering the period marked by the Covid-19 pandemic. The **third step** consisted of the organisation of the five webinars. In collaboration with all the Eureka Partners involved in Task 3.1, a list of questions and statements was created to have a high-level opinion from experts in every single thematic sector. Considering the Covid-19 pandemic it was decided to organise online webinars; one for each thematic working group, using the following working method:

Presentation of work package's activity \Rightarrow quick questions with Mentimeter on the work package outcomes \Rightarrow discussion on Mentimeter results and in particular on unexpected answers.

The **fourth step** was to analyse the outcomes of the webinars. All thematic online webinar was recorded. The statements and questions were evaluated using the App *Mentimeter* (<u>https://www.mentimeter.com</u>) and then discussed with the experts so as to understand what





kind of data and knowledge objects and what kind of end-user needs should be taken into account for the EUREKA platform (EU FarmBook). For this purpose, we thoroughly examined: The results from the *Mentimeter* exercises performed.

The registrations of the five webinars containing the discussions and the experts' input.

For each webinar an excel file containing all related data and information was created.

The **fifth step** was to review FAIR data principles literature and tools to develop the FAIRness assessment framework to evaluate the data quality of the wide range of knowledge objects and data outputs from selected MAPs.

Finally, based on the feedback of the five thematic webinars and the findings of the data quality evaluation of the knowledge objects, recommendations were made to increase the FAIRness of the knowledge objects within the EUREKA EU FarmBook.

2.1 Assessment of WP1 and WP2 outputs

The screening results from WP1 together with the results of the evaluation of end users' needs in WP2, were used to determine which data to be further examined in the thematic working groups and to create inputs for the assessment activity.

Participating in the activities of both WP1 and WP2 (MAPs screening activities, delivery of interviews, organisation of regional workshop, examination of deliverables) 3A-PTA had the possibility to have a good insight into these topics, which helped to better understand how to structure the T3.1 work. It was a big opportunity to have direct contact with some end-users and it facilitated a better understanding of their needs and daily problems in searching for information. An evaluation of the WP1/WP2 outputs was also done during the validation of deliverable D1.4 released by WP1.

The first analysis of WP1/WP2 outcomes was done and the results were studied. Furthermore, the topics to deal with within the webinars were also widely discussed and evaluated together with all WP3 partners during several meetings.





2.2 Creating thematic working groups

After the first analysis of the data (see above), five thematic working groups were formed as it was written in the proposal and based on the view of WP3 partners, we decided to form the working groups by drawing upon the following sectors:

- 1. Arable and Horticultural Crops
- 2. Perennial Crops
- 3. Forestry
- 4. Livestock and Dairy
- 5. Industrial Crops and Agri-food Industry

The objective was to have about 10-15 experts in every thematic working group.

2.2.1 Expert Recruitment

The EUREKA Consortium is a big network, and all the Consortium partners were asked to help in providing contacts of experts, all over Europe, specialized in Arable and Horticultural Crops, Perennial Crops, Forestry, Livestock and Dairy and Industrial Crops and Agri-food Industry. A lot of effort was made in trying to get in touch with experts and stimulate their interest in the EUREKA activities and to convince them to take part in the assessment activities and the webinar. The process went even harder because of the pandemic situation.

The SCAR Strategic Working Group Agriculture Knowledge and Innovation System (SWG AKIS) network was contacted to involve experts from an already large and well-organized European network.

Using the EUREKA Consortium as a "Contact Network" resulted in getting in touch with more than 100 experts spread across EU macro-regions. An invitation letter (Annex I) was created and sent to all the experts. Some of them were also contacted directly by telephone and/or email.

Two different kinds of letters were used; one for those who had already been informed about EUREKA activity and another one for those who had not yet been contacted. This first contact attempt was followed by emails/telephone calls. Further information and explanations were also provided upon request regarding practical issues like the agenda, the link to the webinars. In the end, we had 97 experts interested in participating in our webinar evaluation activity.





2.2.2 Expert Profile

The expert profile based on the end-user archetypes developed in WP2 and used for the mapping of the end-user journeys. The end-users were divided into 5 groups: farmers, foresters, advisors, researchers, and policymakers. As a sixth category, computer scientists were included, who are often represented in working groups by the partners of EUREKA project. Those were the profiles that we planned to involve in the assessment activity.

Five expert lists were prepared, one for each sector (Arable and Horticultural Crops, Perennial Crops, Forestry, Livestock and Dairy and Industrial Crops and Agri-food Industry).

It was hard to find experts in the forestry sector and even harder to motivate them to participate into the webinar. There were only two forestry experts involved. The sectors that were largely represented were "Arable and horticulture crops" and "Livestock and Dairy". Each of them was represented by 11 experts as reported in Figure 2.



Figure 2: Number of experts participating in the 5 thematic working groups







Figure 3: Profile of experts participating in the 5 thematic Working Groups

Figure 3 shows the distribution of the profiles of the experts participating in the 5 thematic working groups. Unfortunately, very few farmers and foresters participated and only in two thematic groups: Perennial Crops, Livestock and Dairy. The largest group of experts was researchers. This biased representation of the various expert categories could be attributed to the strong representation of research organisations in the EUREKA consortium.

Overall, considering the five webinars, we had the participation of 37 experts of which 4 were farmers, 16 researchers, 13 advisors, 2 computer scientists, and 2 policymakers (Figure 4).







Figure 4: Expert profile

2.2.3 Sectoral and geographical distribution of experts

The EUREKA Consortium is a big network with partners from 15 EU Member States. Every partner was asked to help with the recruitment process, with the aim to provide experts from all the 15 countries involved in the EUREKA project. Considering the cultural and socio-economic differences among European geographic regions, a special attention was taken in trying to gather experts from all 4 EU macro-regions (Figure 5).

The aim was also to take a special attention to smallholders and family farms but due to the pandemic situation, a lot of problems occurred in involving farmers and foresters. The lockdown created a series of issues to resolve (interruption in the supply chain, restrictions in human movement, organisation of a safe workplace, etc.) and it seemed that the farmers did not have enough time to participate in activities not directly related to their farm. Farmers were not represented in the working groups to the extent that was aimed for.

The Danube-Balkan region was represented only by Hungary and Slovenia, and finally experts from 12 different EU Member States were involved in the final assessment activity as reported in Table 1.







Figure 5: EUREKA macro-regional division

Table 1: Geographical distribution in the four EU Macro regions

NORDIC-BALTIC			DANUBE-BALKAN		
	Lithuania	2		Hungary	1
	Estonia	3		Slovenia	1
	Denmark	4			
	TOTAL	9		TOTAL	2
ATLANTIC-NORTH SEA			MEDITERRANEAN		
	United Kingdom	3		Spain	3
	France	5		Italy	5
	Belgium	3		Greece	3
	Netherlands	4			
	TOTAL	15		TOTAL	11





2.3 Organisation of Webinars

The assessment activity of the thematic working groups was carried out in online webinars; one for each sector.

The five webinars were conducted in the first half of December following this timetable:

- 1. Working Group: 1) Forestry 9/12/2020 at 11:00 CET
- 2. Working Group: 2) Agri-Food Industry 9/12/2020 at 15:00 CET
- 3. Working Group: 3) Arable and Horticultural Crop 10/12/2020 at 11:00 CET
- 4. Working Group: 5) Perennial Crop 14/12/2020 at 11:00 CET
- 5. Working Group: 6) Livestock and Dairy 15/12/2020 at 11:00 CET

The Webinar agenda together with the Zoom link were sent a few days before the date of the programme to participants.

2.3.1 Program and contents

Together with the Zoom link, a short explanation of the webinar agenda was sent by email, as well as a list of the considered questions/exercises to allow the experts to better prepare for the webinar sessions. Well-reasoned answers were needed to achieve a good evaluation.

The program was organised and implemented with a close cooperation with WP1/WP2 partners and the involvement of all WP3 partners. The **Webinar Programs** (Annex I) were structured as follows:

Program	Description
Introduction	Short presentation of EUREKA project
Part1	Short presentation of WP1 "MA Knowledge Mapping and co-creating MA best practices"
	Interactive moment on WP1 results with Mentimeter (to have the expert's opinion on the most
	important/impactful knowledge objects and create a ranking list) & Open structured discussion.
Part 2	Short presentation of WP2 "Get to know the EU FarmBook end-user"
	Interactive moment on WP2 results with <i>Mentimeter</i> (to have the expert's opinion on End users'
	needs) & Open structured discussion.
Part3	Short presentation of e-platform "the EU FarmBook"
	Interactive moment on categorization of knowledge objects with Mentimeter and round table
	discussion regarding the EU FarmBook
Conclusion	Closing of the Webinar session

Table 2: Webinar Programs



The EUREKA project has received funding from the European Union's Horizon



First point in the agenda was the presentation of WP1's and WP2's results and then the *Mentimeter* exercise followed by a discussion on its outcomes. After that, a short presentation of the e-platform was followed by some questions and inputs from the experts. At the end, an overall discussion took place, and conclusions were drawn, where all the participants had the possibility to suggest improvements or other recommendations.



Figure 6: Screenshot of a Webinar - Introduction



Figure 7: Screenshot of a Webinar - Presentation WP1 results







Figure 8: Screenshot of a Webinar - Mentimeter Exercise on WP1 results



Figure 9: Screenshot of a Webinar - Presentation of WP2 results







Figure 10: Screenshot of a Webinar - Presentation of the platform "the EU FarmBook"

2.4 Part1: Data sets and knowledge objects

After the presentation of WP1 activities and outcomes, in every thematic webinar, the first *Mentimeter* exercise question was asked:

QUESTION 1.1 Please rank these clusters of knowledge objects, in order of importance/ usefulness, according to your field and experience (please select at least 5 items):



Figure 11: Mentimeter Exercise Question 1.1





The items listed above were the output categories identified in the Deliverable D1.4 that reflects a part of the WP1's activity.

The second exercise on *Mentimeter* in the first part of the webinar was focused on the information (knowledge of interest) to be considered in the e-platform. The exercise was divided into three parts: the first from the advisors' point-of-view, the second from the farmers'/foresters' point of view, and the third from the researchers' point-of-view. In WP1, knowledge of interests was listed by these three end-user groups, so the issue was to understand whether these lists were complete or if the experts wanted to add something important and/or essential to put in the e-platform. The three questions were the following:

<u>QUESTION 1.2</u> If you were an advisor: would you like to add something on this knowledge of interest listed above that you consider useful and important?



Figure 12: Mentimeter Exercise Question 1.2

<u>QUESTION 1.3</u> If you were a farmer/forester: would you like to add something on the knowledge of interest listed above that you consider useful and important?







Figure 13: Mentimeter Exercise Question 1.3

<u>QUESTION 1.4</u> If you were a researcher: would you like to add something on the knowledge of interest listed above that you consider useful and important?



Figure 14: Mentimeter Exercise Question 1.4

2.5 Part2: End user's needs

The second part of the webinar focused on WP2 activities and outcomes. The main objective of WP2 was to understand the end-users and in particular to understand their needs. A huge evaluation job was done in WP2 (40 interviews, 4 regional workshops and 2407 survey response)





to identify their needs and some of the results were unexpected. The unexpected features of the EUREKA platform requested by end-users were an interesting aspect to be further analysed. So, after a specific meeting with the WP3 and WP2 Partners, the second part of the *Mentimeter* exercise was decided to focus upon those unexpected key features. The questions were the following:

<u>QUESTION 2.1</u> Please rank these features, in order of importance/usefulness, according to your field and experience (please select at least 5 items)

Unexpected key features:



Figure 15: Mentimeter Exercise Question 2.1

2.6 Part 3: The e-platform

The last part of the webinars was the presentation of the platform ("Challenges and opportunities from the integration of digital content into the EU FarmBook"). The aim of this presentation was to highlight the key points related to the creation of a centralized repository enabling access to Agriculture-related digital content and information. At the end of the presentation, the ideas of some key functions were shared and evaluated with the experts, again using the *Mentimeter*. In the first two webinars for the Forestry and Agroindustry sector, the following questions were asked from the experts:





Question 1: In your opinion, is it useful to enable access to the content available in the EU FarmBook through different content categories (namely, documents, videos, audios (i.e., podcasts), presentations, images, datasets, and software applications)?
Question 2: Do you think that it is useful to categorise the content in terms of the purpose for

which it has been created?

It soon turned out that the result was not useful for the creation of the EU FarmBook, as it always showed "Yes" in 100%. Therefore, it was decided to replace them with other two, more useful topics.

The first question in this third part regarded two different categorisations when browsing, i.e.:

The FAO approach: "Farming", "Livestock", "Forestry" and "Fisheries and Aquaculture".

The EIP-AGRI approach: "Forestry", "Agri-Food Industry", "Arable and Horticultural Crop", "Perennial Crop", and "Livestock and Dairy"

Hence, the first question in this final part of the webinar concerned the use of one or the other approaches.

<u>Question 3.1</u> Which of the above approaches do you consider as the more appropriate to consider?



Figure 16: Mentimeter Exercise Question 3.1

The second question of the third part was an open one. The idea was to have some input from the participants without influencing them with other people's input (the results from WP1/WP2).





Thus, the last question of the webinar was the following:

<u>Question 3.2:</u> We are also thinking about enabling access to content through broad (not sectorrelated) themes. These themes could be, for instance, "environment" or "society" or "policies". Could you make suggestions about such theme-related ideas?



Figure 17: Mentimeter Exercise Question 3.2

3 Webinar's outcome and analysis

3.1 Part1: Data sets and knowledge objects

In the first part of the webinar, the experts were invited to rank clusters of knowledge objects (output categories identified in the WP1 Deliverable D1.4) and the overall result of the five thematic Working Groups was the following ranking list:

Table 3: Ranking list of knowledge objects resulted from the 5 Thematic Working Groups

Knowledge objects	Ranking
PUBLICATIONS	1





SOFTWARE AND TOOLS	2
VIDEO/AUDIO MATERIALS, WEBINAR, PODCAST	3
GUIDELINES, STANDARDS	4
DEMONSTRATIONS	5
NETWORKS	6
DATASETS	7
REGISTERS/DATABASES	9
INFOGRAPHICS, PRINTED INFO MATERIALS	9
INTELLECTUAL PROPERTY RIGHTS (IPR)	10

The knowledge object considered to be the most important were "Publications" followed by "Software and Tools" and "Video/Audio materials, webinar, podcast". This result reflects more or less the result of all webinars (the result of each webinar is shown in Annexes III-VII). Although, "Publications" are in the 6th place in the Perennial crop's webinar, where the most popular item was "Demonstrations" and "Video/Audio materials, webinar, podcast". This could be because the webinars which had farmers'/foresters' expertise (Perennial Crops and Livestock and Dairy) voted more for practical knowledge objects, although "publications" were in the first place in the Livestock and Dairy Webinar.

Intellectual Property rights (IPR) was in the last place in every Working Group.

The knowledge object "publications" still seems to be favoured even though there are already a lot of existing platforms, where such information is available. It is also necessary to keep in mind that these kinds of outputs are often available in a pdf format, which is difficult to read on a smartphone. Some experts (Agroindustry group) suggested to put a short summary/abstract on the e-platform, which is more easily readable and understandable for a broad public. Then it is always possible to put a link to download the whole publication.

Many experts in different thematic working groups were surprised to find that the "network" did not have a more important place on the ranking list. Some experts emphasized the fact that farmers always work in small networks, although they are often competitive with each other; their networks often consist of neighbours and other farmers. The experts underline the importance of bringing farmers together, also from different sectors and also from different countries. It moreover seems to be very important to bring together practice and knowledge. Researchers would appreciate it very much to get to know the farmers'/foresters' needs.





Experts in the Livestock and Dairy group insisted on the importance of networking and in creating direct contacts between Farmers, Advisors, and Researchers stating that networks (with good interaction and communication between different actors), are also important for avoiding duplication of projects and outputs.

Among the farmers and advisors in the thematic working groups, several were interested and specialized in Organic farming. As it is not programmed to have a specific thematic group for organic farming in the EU FarmBook, it was suggested to also create a link to an already existing platform (www.organic-farmknowledge.org).

The second exercise on *Mentimeter* in the first part of the webinar was focused on the information (knowledge of interest) to be considered in the e-platform. The exercise was divided in three parts; the first from the advisors' point-of-view and then from farmers'/foresters' and researchers' point-of-view (See questions in Figure 12, 13 and 14).

Focusing on these three profiles, most suggestions were received for advisors and farmers and less for researchers. This could be motivated by the fact that the list (knowledge of interest) for this group was already quite long and complete (figure 14). The complete *Mentimeter* exercises with all suggestions are available in Annexes III-VII.

The knowledge of interest suggested by the experts, to be included in the e-platform was grouped and listed in 10 clusters of tangible and intangible data:

- Subsidies, funds, calls, market information
- Policy information, regulations, opinion papers
- Publications, fact sheet, scientific papers
- Farm/forest management, best practices, innovations
- Tutorial, demonstrations, training
- Databases, registers
- Network, groups, communities, sharing
- Contacts, list of experts/advisors
- Tools, software, Apps, weather forecasts
- Newsletter, info events





Some of them were already listed in the *Mentimeter* questions (Figure 12, 13 and 14) (i.e. Scientific papers, tools, farm management, newsletter)

A ranking list of the most voted items was created for all webinars and the differences between the various thematic working groups were studied.

Knowledge of interest	Ranking
SUBSIDIES, FUNDS, CALLS, MARKET INFORMATION	1
NETWORK, GROUPS, COMUNITIES, SHARING	2
POLICY INFORMATION, REGULATIONS, OPINION PAPERS	3
TUTORIAL, DEMONSTRATIONS, TRAINING	4
FARM/FOREST MANAGEMENT, INNOVATIONS, BEST PRACTICE	5
CONTACTS, LIST OF EXPERTS/ADVISORS	6
PUBLICATIONS, FACT SHEET, SCIENTIFIC PAPERS	7
DAT ABASES, REGISTERS	9
TOOLS, SOFTWARE, APPS, WEATHER FORECASTS	9
NEWSLETTER, INFO EVENTS	10

Table 4: Ranking list of "knowledge of interest"

The overall most suggested knowledge of interest, suggested by the experts, was "subsidies, funds, calls, market information". This was not the case for Researchers, however, for whom the most suggested one was "databases and registers".

In the second place one can find "Network, groups of interest, communities, sharing" and here again, this macro group was not favoured by Researchers. On the second place for Researchers, you could find "Publications, fact sheet, scientific papers".

On the third place as most suggested was "Policy information, regulations, opinion papers".

Some suggestions not easily classifiable but interesting were:

- "database of farmers wanting to participate in research projects"
- "website easily accessible and simple information for broad public"
- "good working search engine"
- "easiness the price of a solution"





3.2 Part2: End user's needs

The second part of the webinar agenda focused on the end-user's needs and on a specific result of WP2 regarding key features to be included in the EU FarmBook, which were unexpected. So, the experts were invited to rank these "unexpected" key features in order of their importance. Considering the overall results of the five thematic webinars, the expert's preferences revealed this ranking list:

	ranking
Information automatically tailored to preferences	1
See other people's opinions on information	2
Emails with information based on preferences	3
Rate information on the platform	5
Create own user profile	5
User gives opinion to info on platform	6

Table 5: Ranking list of unexpected key features

The most voted feature was "Information automatically tailored to preferences". This feature indicates the necessity to search for information in a quick and trustworthy way, as well as the possibility to have a quick look at information and news only in those areas that regards to the end-user's field of interest.

The second most voted was "See other people's opinions on information". This key feature helps the end-user to see what other end users think about a certain piece of content and it is also linked to the key features that have been less voted, (i.e., "User gives an opinion to info on the platform"). This is somewhat interesting as the first statement cannot exist without the second statement. So, this shows a common characteristic of end-users, namely, that people tend to ask for more than they are willing to give.

It was suggested by some experts that it is important to motivate end-users to register on the eplatform also using some kind of compensation/benefit when getting registered on the eplatform.





3.3 Part 3: The e-platform

In this last part of the webinar agenda, the participants provided a lot of information. The aim of the presentation "Challenges and opportunities from the integration of digital content into the EU FarmBook" was to highlight the key points related to the creation of a centralized repository enabling access to Agriculture-related digital content and information. At the end of the presentation, some key functions were evaluated and/or suggested by the experts.

The first question in this third part regarded two different categorisations when browsing, i.e.:

- The FAO approach: "Farming", "Livestock", "Forestry" and "Fisheries & Aquaculture".
- The EIP-AGRI approach: "Forestry", "Agri-Food Industry", "Arable and Horticultural Crop", "Perennial Crop", and "Livestock and Dairy"

FAO has a more international and generic approach in categorizing the agricultural sector and it also comprises "Fisheries and Aquaculture" which is missing in the EIP-AGRI approach. On the other hand, the EIP-AGRI is more oriented towards European agriculture and incorporate a finer level of detail as it contains more fine-grained categories such as "Arable crops", and "Perennial crops".



Figure 18: The experts' choices to use FAO or EIP-AGRI categorisation





The experts that voted for the FAO approach, appreciated the more generic subdivision, and they also preferred the inclusion of "Fisheries and Aquaculture". One person thought that the EIP-AGRI approach focused too much on food processing and that Agroindustry does not actually belong to Farming.

The EIP-AGRI approach on the other hand was preferred because it reflects more the partition of European agricultural sectors and also because the project is an EU funded initiative.

About 74% of the experts voted for the EIP-AGRI approach, which is the approach that was already indicated in the EUREKA proposal.

The second question of the third part was an open one and generated a lot of input from the participants when asking them *"We are also thinking about enabling access to content through broad (not sector-related) themes. These themes could be, for instance, "environment" or "society" or "policies". Could you make suggestions about such theme-related ideas?"*

With this last question, the experts were provided the opportunity to propose different themes/sectors to consider for facilitating user navigation in the e-platform. This was interesting because every expert had a different experience in different fields, and some noteworthy suggestions were given here. The outputs (Table 6) demonstrate a stimulating interest in current topics by all experts in every Working Group.

Topics related to the environment like climate change, biodiversity, soil water, European Green Deal, appear to be the most interesting and most frequently quoted. Moreover, themes such as subsidies databases, legislation, fund, and market information were proposed as crossover topics (see Table 6).

Forestry	Agrofood Industry and Industrial Crops	Arable and Horticultural Crop	Perennial Crops	Livestock and Dairy
ecosystem	environment	energy	sustainable agriculture	economics
ecosystem services	Innovation & Policy	soil	digital	country/region
policy	climate change	biodiversity	organic	biodiversity

Table 6: Non-thematic related themes suggested by Working Groups





subsidies	market information	water	communication funding	high nature value
	databases	market information		farming food sovereignty
	subsides	sectoral themes		sustainable agriculture
	regulations	databases		soil
	innovations	regulations		diseases
	climate	subsides		direct sale
	water	policy		carbon
	social acceptance of your farm	environment		soil GHGs
	lean management	legislation		air quality/emissions
	B2C	climate		business strategy
	climate change	circular economy		human resources (staff, hiring, contracts)
		social		input cost trackers
		business		organic/conventional sector materials
		food chain		policies with the current legislation on EU level
		green deal themes		national levels society
		organic agriculture		producers/consumers perspective
				international agreements in agriculture
				economics

4 Lessons learned and conclusions

The activities of task 3.1 in Work Package 3 have aimed to select the data sets and knowledge objects to include in the EU FarmBook. The activity started with an assessment of the WP1 and WP2 outputs and it continued with a data evaluation organised in an assessment activity which was carried out by sectoral working groups. In the end, an evaluation of all this activity was done and the outcomes can be summarized as follows:





A ranking list of knowledge objects selected in the WP1, to put in the e-platform, was prepared:

Knowledge objects	Ranking
PUBLICATIONS	1
SOFTWARE AND TOOLS	2
VIDEO/AUDIO MATERIALS, WEBINAR, PODCAST	3
GUIDELINES, STANDARDS	4
DEMONSTRATIONS	5
NETWORKS	6
DATASETS	7
REGISTERS/DATABASES	9
INFOGRAPHICS, PRINTED INFO MATERIALS	9
INTELLECTUAL PROPERTY RIGHTS (IPR)	10

- WP2 faced the problem of adapting the information to be included in the platform to satisfy the interests of the end-user. This tailoring requires some kind of registration to the platform. Sometimes it can be difficult for various reasons (lack of time, lack of trust, etc). Thus, to enhance the motivation to do this registration there should be some kind of compensation or benefit for the end-user.
- A tailormade search of information is often used in e-platforms to save time when seeking
 information but it can also be a limit, restricting one's view as it presents "answers" and
 information connected to a particular area/sector. Some experts thought that it is better
 to receive as many results as possible and then it is up to them to proceed to the selection
 of the results to view.
- The overwhelming majority of the experts preferred the EIP-AGRI approach when it comes to structuring the access to content. However, this categorisation does not seem to cover all sectors. Unfortunately, it does not consider the "fishery and aquaculture" sector but as EUREKA is an EU-funded project many experts found it logical to embrace the EIP-AGRI approach. A possible solution could be to add the "fishery and aquaculture" category to the EIP-AGRI approach.
- A lot of ideas were proposed for non-sector-related themes to use while accessing the eplatform. The most suggested macro groups were related to:
 - Environmental issues (climate changing, biodiversity, ecosystem)





- o Subsides, economics, and market information
- Legislation and policies
- Some interesting suggestions came out from the *Mentimeter* exercises but also from the discussions with the experts performed during the webinars; the most interesting are the followings:
 - English is the most used language when searching on Google but some of the experts underlined the difficulties of language barriers. There are still a lot of end-users not having the capability to understand and correctly use the English language. Nowadays it is very common to utilize the translation button, but it should be useful to have at least an introduction in the local language on the first page of the e-platform. But overall, the language does not seem to be a big issue anymore, maybe because of a wider use of easy translation.
 - The sustainability of the e-platform and how to continue the functionality of the EUREKA project was a frequent question. Some of the experts underlined the importance of connection with other platforms and also updating the information constantly in order to always remain contemporary, up to date, and trustworthy.
 - Often, when farmers and advisors search for information, they write their questions directly into the search engine (Google). They are used to do it. This should be kept in mind when designing the e-platform and its indexing.
 - It is also important to keep in mind that farmers and advisors prefer to immediately resolve their problems at the moment when they occur, regardless of where they are (at home, in the field driving a tractor, etc) thus it may be fundamental to have the possibility to offer answers and information readable directly on a smartphone or a tablet.
 - Networking is a non-tangible output, and it seems to be a very important one. Farmers already participate in small, non-structured networks like groups of neighbours or other farmers with or without the participation of advisors. So, this is absolutely a project outcome to take into account!





5 Data Quality Evaluation

Expanding the capacity of the EUREKA EU FarmBook poses the challenges of making sure that data/knowledge objects available in the EUREKA project implement the FAIR Principles. It requires evaluation and validation of some of the critical elements of the FAIR principles like the metadata describing the knowledge objects, the technical environment of the repository where knowledge objects will be stored, and to some extent data management policies to ensure the sustainability of knowledge objects within the platform. Chosen Multi-Actor Projects (MAPs) and their knowledge objects for the EUREKA project are heterogeneous in several ways. The majority of MAPs differ in the domain they address, the content they deliver, and most importantly, the knowledge output format (e.g., text documents, videos, podcasts, datasets, etc.)^{1.} An evaluation and validation of knowledge objects are needed based on FAIR Principles, so it will be made available in FAIR Data Repository to potential stakeholders. Data quality evaluation of a large variety of knowledge objects available from the MAPs allows more significant data normalisation and potential enrichment of possible missing metadata knowledge output. Based on the inputs of WP1² and WP2³ we have selected a small, representative sample of knowledge objects from various MAPs and evaluated the FAIRness of the knowledge objects to see to what extent they conform to the FAIR principles. This section aims to measure the data quality based on the FAIR principles and provide an opportunity to suggest a set of recommendations to enhance the FAIRness of the knowledge objects within the EUREKA FAIR data repository.

6 FAIR Principles

6.1 Conceptualisation of the FAIR principles

In the past few decades, an exponential volume of data output has been made available from a wide range of research disciplines. The potential impact of these data outputs is enormous. However, reusing these data outputs for future research development is still a significant challenge (Rychlik et al., 2018). Despite the re-evaluation of technological advancements, lack of

³ Vágó et al. (2021) D2.2 Report on end-user archetypes and end-user journeys. EUREKA project.



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¹ A detailed discussion about the categories of outputs made available from the MAPs and the categories of knowledge objects recognised in the context of the EU FarmBook data repository schema, by building upon the work reported in Deliverable 1.4, takes place in Section 3.4 ("EU FarmBook repository schema").

² Candek-Potokar et al. (2021). D1.4: Report Knowledge Mapping and MAA best practices. EUREKA project.


description, community standards and missing usage licencing of data output make most data unfit for future research development (Pasquetto et al., 2017). To combat this, the FAIR data principles provide a vital structure for the publication of knowledge objects such as articles, datasets, code, workflows, and research objects, and so on.

The FAIR data principles were first formulated at the Lorentz conference in 2014 and published some of the conference's discussion via FORCE11⁴. Later, the FAIR data principles emerged in 2016 from a cross-organizational, interdisciplinary effort to refine the availability and usability of digital research data and other digital outputs of research, regardless of their public availability (Wilkinson et al., 2016). FAIR principles motivate making data, software, and other digital outputs of research or any research project as Findable, Accessible, Interoperable, and Reusable as possible. According to Wilkinson et al. (2019)⁵, the FAIR data principles provide an aspirational state of FAIRness for knowledge objects and act as a guiding beacon for high-quality data stewardship. However, achieving them still depends upon their interpretation by the knowledge objects' provider and user. Since the publication of the FAIR principles, domain-specific efforts and FAIR enabling environments have been started to support the publishing and managing of knowledge objects. More and more sector and domain-specific practices encourage integrating FAIR principles for publishing and managing knowledge objects.

The FAIR principles stress on four foundational principles: Findability, Accessibility, Interoperability, and Reusability⁶.

The findable principle specifies that data should be identified, described, and registered or indexed clearly and unequivocally (Jacobsen et al., 2020). This principle requires knowledge objects to affiliate with a unique and persistent identifier (Juty et al., 2020), main characteristics of data are systematically specified, ideally using standard formats; and that these are stored or indexed in a public resource such as a data archive or institutional repository (Weigel et al., 2020). The accessible principle specifies that datasets should be accessible through a defined access procedure, ideally by automated means. It entails the establishment of authentication and

⁶ Jacobsen et al. (2020), FAIR Principles: interpretations and implementation considerations.



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⁴ See https://www.force11.org/group/fairgroup/fairprinciples

⁵ Wilkinson et al. (2016)



authorisation procedures for access and the implementation of automated data retrieval protocols where appropriate (Brewster et al., 2020). Metadata should always be accessible even if the underlying data is no longer available (Jacobsen et al., 2020).

The interoperable principle specifies that data and metadata are conceptualised, expressed and structured using common and published standards. It entails drawing on standard technical and semantic data formats, variables and ontologies. Moreover, such standards should be publicly published, traceable and accessible (Wilkinson et al., 2016).

Finally, the reusable principle specifies the data's characteristics, including their provenance. Metadata should be described in detail according to domain-relevant community standards, with clear and accessible conditions for use. It entails providing and publishing accurate and relevant data descriptions, access and usage licenses, the community standards that have been employed in the process, and the associated provenance for every dataset (Jacobsen et al., 2020; Jones et al., 2020).

Each FAIR data principle can be further explored through sub principles (Table 7). Each of these sub principles aims to maximise the FAIRness of the knowledge objects either to humans or machines with the least amount of human intervention.

Main Principle	Explanation	Sub-Principle
Findability	Datasets should be described, identified and registered or indexed in a clear and	F1: (Meta)data are assigned a globally unique and persistent identifier
		F2: Data are described with rich metadata
		F3: (Meta)data clearly and explicitly include the identifier of the data
		F4: (Meta)data are registered or indexed in a searchable resource
Accessibility	Datasets should be accessible through a clearly defined access procedure, ideally	A1: (Meta)data are retrievable by their identifier using a standardised communication protocol
	using automated means. Metadata should always remain accessible	A1.1: The protocol is open, free, and universally implementable
		A1.2: The protocol allows for an authentication and authorisation procedure, where necessary

Table 7: FAIR principles, based on (Wilkinson et al., 2018)





		A2: (Meta)data are accessible, even when the data are
Interoperability	Data and metadata are conceptualised, expressed and structured using common, published standards	 I1: (Meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation I2: (Meta) data use vocabularies that follow FAIR principles I3: (Meta) data include qualified references to other (meta)data
Reusability	Characteristics of data and their provenance are described in detail according to domain-relevant community standards, with clear and accessible conditions for use	R1: (Meta)data are richly described with a plurality of accurate and relevant attributes R1.1: (Meta)data are released with a clear and accessible data usage license R1.2: (Meta)data are associated with detailed provenance R1.3: (Meta) data meet domain-relevant community standards

6.2 FAIR assessment tools

FAIR Principles are aspirational, and they do not define FAIRness standards for knowledge objects, but rather describe pathways to achieve higher FAIRness of knowledge objects by a continuous change in the feature, attributes, and creating a fair environment for knowledge objects (Wilkinson et al., 2016). Within the Eureka project, FAIRness is defined as the degree to which knowledge objects are Findable, Accessible, Interoperable, and Reusable in the EU FarmBook platform. Higher FAIRness of available knowledge objects in the EU FarmBook would maximise their use by identified stakeholders. Every year a significant volume of data and knowledge objects are produced in the agri-food sector in Europe and beyond. Evaluating the FAIRness of selected knowledge objects for EU FarmBook is essential. To evaluate the FAIRness of the selected knowledge objects requires a FAIR assessment tool or metrics.

Within the EUREKA project, a systematic review of the FAIR data principles and available FAIR assessment tools was conducted to find the best possible FAIR assessment tool for the EUREKA project (Table 8). The systematic review pointed out that various organisations and stakeholders provide several approaches to evaluate the FAIRness of data and knowledge objects. There are three main approaches in practice: manual, automatic, and hybrid. Several tools and matrices have been developed for each approach. Table 6 provides a list of FAIR metrics and tools identified





from the review. Each approach has its usability and limitations; for example, in the case of manual approaches, the assessment is subjective to the data creator and assessor's knowledge. People responsible for FAIR assessment might misjudge or over-estimate the FAIRness of the knowledge objects or data based on their knowledge of FAIR principles and FAIRness assessment experience. The manual approach includes a set of questions that needs a different level of details, and most importantly, they are continuously evolving. The majority of FAIR metrics and tools fall in this category.

The automated FAIRness evaluation tools, on the other hand, rely on a more technical setup. Knowledge objects are assessed on whether they are machine-readable, have a PID and rich metadata, provide additional documentation describing data usage license, and use data standards. In order to properly check these features a basic technical infrastructure is assumed, which the majority of EUREKA knowledge objects fail to provide.

Some subject domains need limited compliance with FAIR Principles to achieve higher FAIRness whereas some need more details. What FAIR Principles mean for one community might mean something entirely different for another, which brings up the concept of 'FAIR Enough'⁷. Within the Eureka Project, FAIR enough concepts were established to achieve a higher degree of FAIRness. Moreover, definitions were created on which criteria of the FAIR principles might be adopted or ignored in order to develop a FAIRness assessment framework for the EUREKA EU FarmBook.

Table 8: FAIR metrics and tools

SI. No	Resource	Execution type	Organisation	Target objects	Reference
1	5 Star Data Rating Tool	Manual - questionnaire	CSIRO OzNome	Datasets	http://5stardata.csiro.au / (Hasnain and Rebholz- Schuhmann, 2018)

⁷DANS:FAIRenough?

https://docs.google.com/forms/d/e/1FAIpQLSf7t1Z9IOBoj5GgWqik8KnhtH3B819Ch6ID5KuAz7yn0I0Opw/viewform



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2	Data Stewardship Wizard	Predictive; based on a manually filled questionnaire	ELIXIR NL and ELIXIR CZ	All digital objects	(Pergl et al., 2019)
3	F-UJI	Automated	FAIRsFAIR (PANGAEA)	Datasets	(Devaraju et al., 2020)
4	FAIR Data Self- Assessment Tool	Manual - questionnaire	ARDC	Datasets	https://ardc.edu.au/reso urces/working-with- data/fair-data/fair-self- assessment-tool/
5	FAIR Evaluator	Automated	FAIRmetrics.org	All digital objects	(Wilkinson et al., 2019)
6	FAIR enough?	Manual - checklist	DANS	Datasets	https://docs.google.com /forms/d/e/1FAIpQLSf7t 1Z9IOBoj5GgWqik8Knht H3B819Ch6ID5KuAz7yn0 I0Opw/viewform
7	FAIR-Aware (BETA)	Manual - questionnaire	FAIRsFAIR (DANS)	Datasets	<u>https://github.com/DAN</u> <u>S-KNAW/fair-</u> <u>assessment-tool</u>
8	FAIR-Checker	Automated	IFB (ELIXIR-FR)	All digital objects	https://fair- checker.france- bioinformatique.fr/base metrics
9	FAIRdat	Manual - questionnaire	DANS	Datasets	https://www.surveymon key.com/r/fairdat
10	FAIRness self- assessment grids	Manual - checklist	RDA-SHARC IG	All digital objects	(David et al., 2018)
12	GARDIAN FAIR Metrics	Manual - checklist	GARDIAN	All digital objects	https://gardian.bigdata. cgiar.org/files/GARDIAN _FAIR_metrics_guide.pd f
13	RDA Maturity Model	Manual - checklist	RDA FAIR Data Maturity Model WG	All digital objects	(Group, 2020)
14	SATIFYD - Self- Assessment Tool to Improve the FAIRness of Your Dataset	Manual - checklist	EUDAT summer school		(Jones and Grootveld, 2017)





7 FAIRness assessment framework and analysis

The EUREKA project seeks to bring together all research and other digital outputs from the large number of MAPs funded under the H2020 framework programme in recent years. It is essential to understand the role and objective of such knowledge objects in digitally-enabled research, development and commercial practice in the agri-food sector, and at the same time necessary to measure the quality of these knowledge objects before it is included in the EUREKA EU FarmBook platform. After conducting a literature review on FAIR Principles and the available FAIR assessment tools and metrics, it has been observed that present tools and matrices cannot be used for the evaluation of the quality of these knowledge objects, directly. The majority of the MAPs selected for the EUREKA EU FarmBook platform have limited information and it is also impossible for the FAIR assessment tools to measure the quality of the knowledge objects. Considering these limitations and a literature review of FAIR assessment tools and metrics, we proposed a manual FAIRness assessment. The FAIRness assessment is based on the 'FAIR Enough' ideology to evaluate the FAIRness of the digital outputs based on designed questions for each FAIR sub-principles. Based on FAIR principles, a list of questions is prepared to evaluate the FAIRness of knowledge objects and their discovery and further use. For the current work, the FAIRness assessment is based on the human perspective at present and the recommendations proposed in this study would encourage machine automated FAIRness evaluation of knowledge objects in the future for the EU FarmBook.

The FAIRness of the knowledge objects was evaluated using several test questions for each FAIR sub-principle which gauges compliance of knowledge objects on FAIR. Details of the FAIR assessment framework are presented in Annex VIII. For the evaluation of the FAIRness of the knowledge objects, we have chosen a three-level Likert scale to categorise the score on the FAIRness evaluation. We used three levels: Poor [0 -.33 score range], Average [.34 -.66 score range] and Exemplary [.67 - 1]. For each designed question for FAIR sub-principles, a possible explanation was derived from the literature review, and based on that each knowledge object was scored. The results of FAIRness evaluation present at three levels:

- At each fundamental FAIR principle
- At overall FAIRness of the selected knowledge objects for the EUREKA project





• At the selected MAPs level

7.1 Roadmap of FAIRness assessment

The selection of 19 MAPs was based on the findings of Deliverable 1.4. (Čandek-Potokar et. al., 2021 examined the EIP-AGRI and CORDIS websites of the European Commission to identify all the EU-funded (i.e., until February 2020) on-going MA projects in the agriculture food area. In the first phase, a total of 101 MA projects were identified. Further analysis of these 101 MAPs was carried out to understand the types of data and knowledge objects that different projects have produced, how this data was collected and processed into knowledge objects, as well as their importance to end-users, and whether this outcome is available according to FAIR principles. For each project, a spreadsheet was created with information on the types of data/knowledge produced and the examples with an access link. Finally, from the total set of the 101 MA projects, 19 MAPs were selected to carry out the knowledge objects' data quality evaluation based on the FAIRness assessment framework. For these 19 MAPs, the WP1 team developed a detailed questionnaire and also conducted in-depth on-line interviews to obtain insights about the knowledge objects. The questionnaire was split into an on-line survey conducted before the interview and a face-toface interview discussion. The findings from these in-depth on-line interviews have been presented in Deliverable 1.4 and become the basis for selecting the 19 MAPs for quality assessment of the knowledge objects. The selection of 19 MAPs has been based on the type of the project (e.g., RIA, CSA, IA), its duration (at least in the first reporting period), and the topic of the project (according to EIP-AGRI categorisation). Table 9 provides the details of the selected projects⁸.

Table	9:	Selected	MA	projects	

Acronym	Full title	Duration	Coordinato	Countr	Туре	Торіс
				У		
BOND	Bringing Organisations and Network Development to higher levels in the	2017- 2020	Coventry University	UK	CSA	Human, social capital
	farming sector in Europe					

⁸ <u>https://ec.europa.eu/eip/agriculture/en/about/multi-actor-projects-scientists-and-farmers</u>



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Diverfarming	Crop diversification and low-input farming across Europe: from practitioners engagement and ecosystems services to increased revenues and chain organisation	2017- 2022	Universida d Politecnica de Cartagena	ES	RIA	Sustainable primary production
DIVERSIFOOD	Embedding crop diversity and networking for local high-quality food systems	2015- 2019	INRA	FR	RIA	Sustainable primary production
EMPHASIS	Effective Management of Pests and Harmful Alien Species - Integrated Solutions	2015- 2019	Universita degli studi di Torino	IT	RIA	Sustainable primary production
FAIRshare	Farm Advisory digital Innovation tools Realised and Shared	2018- 2023	TEAGASC	IRL	CSA	Human, social capital
Feed-a-Gene	Adapting the feed, the animal, and the feeding techniques to improve the efficiency and sustainability of monogastric livestock production systems	2015- 2020	INRA	IT	RIA	Sustainable primary production
InnoForEst	Smart information, governance, and business innovations for sustainable supply and payment mechanisms for forest ecosystem services	2017- 2020	Hochschul e Fur Nachhaltig e Entwicklun g Eberswald e	DE	IA	Rural innovation
loF2020	Internet of Food and Farm 2020	2017- 2020	RSK Environme nt Limited	UK	IA	Rural innovation
LIVERUR	Living Lab research concept in Rural Areas	2018- 2021	Fundacion Universitar ia San Antonio	ES	RIA	Rural innovation
LIVESEED	Improve performance of organic agriculture by boosting organic seed and plant breeding efforts across Europe	2017- 2021	Internation al Federation of Organic Agriculture Movement s European Union Regional Group	SE	RIA	Sustainable primary production





NoAW	Innovative approaches to turn agricultural waste into ecological and economic assets	2016- 2020	INRA	FR	RIA	Sustainable primary production
МусоКеу	Integrated and innovative key actions for mycotoxin management in the food and feed chain	2016- 2020	Consiglio Nazionale delle Ricerche	IT	RIA	Sustainable primary production
NEFERTITI	Networking European Farms to Enhance Cross Fertilisation and Innovation Uptake through Demonstration	2018- 2021	Association de Coordinati on Technique Agricole	FR	CSA	Human, social capital
ΟΡΤΙΜΑ	Optimised Pest Integrated Management to precisely detect and control plant diseases in perennial crops and open-field vegetables	2018- 2021	Agricultura I University of Athens	GR	RIA	Sustainable primary production
RUSTWATCH	A European early-warning system for wheat rust diseases	2018- 2022	Aarhus Universitet	DK	RIA	Sustainable primary production
SiEUGreen	Sino-European innovative green and smart cities	2018- 2021	Norges Miljo-Og Biovitenska plige Universitet	NO	IA	Rural innovation
SmartAgriHubs	Connecting the dots to unleash the innovation potential for digital transformation of the European agri-food sector	2018- 2021	Stichting Wageninge n Research	NL	IA	Rural innovation
TomRes	A novel and integrated approach to increase multiple and combined stress tolerance in plants using tomato as a model	2017- 2020	Universita degli studi di Torino	IT	RIA	Sustainable primary production
TREASURE	Diversity of local pig breeds and production systems for high-quality traditional products and sustainable pork chains	2015- 2019	Agricultura I Institute of Slovenia (KIS)	SI	RIA	Sustainable primary production

The initial findings reported in Deliverable 1.4. have summarised the type of knowledge objects of interest for the EUREKA EU FarmBook platform. These knowledge objects were further grouped into clusters of tangibles (e.g., publications) and intangible outputs (e.g., networks of people, demo farms, living labs, innovation hubs), as depicted in figure 13. As part of Deliverable 3.1., these knowledge objects were





further evaluated for their usability in thematic expert workshops where a range of stakeholders participated⁹ (Section 3 and 4).





8 Results:

8.1 Data quality of knowledge objects

8.1.1 Findability of knowledge objects

Assessment of knowledge objects showed that about 65% of the total knowledge objects performed poorly on findable principle's requirement. About 23% of the total knowledge objects met the findable principle's requirement. It was observed that the majority of the knowledge objects performed poorly on F1 and F3 sub-principles; these sub-principles evaluated if selected knowledge objects were assigned a globally unique and persistent identifier and the metadata utilized it. It was also observed from the analyses that the majority of knowledge objects have limited metadata. The majority of knowledge objects like journal articles, data, conference proceedings, books, and they performed exemplary on the findable principle's requirement. These knowledge objects explicitly used globally unique and persistent identifiers, have rich metadata, and are publicly available to everyone. Knowledge objects like newsletters, presentations,

⁹ Information about the respondent (Farmer, advisors, researcher, food processor, student, teacher, policymaker, Other)





reports, practice abstracts, booklet, flyers, and tools performed poorly and one of the main reasons for that is the poor performance on the F1 and F3 sub-principles.



Figure 20: Findable module results; i. Findable FAIR principles and ii. Findable sub-principles



Figure 21: Performance of knowledge objects on findable principles

8.1.2 Accessibility of knowledge objects

The evaluation of the "Accessible" FAIR principle showed that 61% of total knowledge objects performed exemplary. The majority of knowledge objects were publicly accessible and required no authorization for accessing the knowledge objects from selected MAPs. These were also the





reasons for 85% of total knowledge objects meeting compliance for A1.1 and A 1.2 sub-principles. However, findings from the evaluation of the A2 sub-principles showed that not all knowledge objects were compliant with the requirement of metadata records being available even if the data itself is no longer available. In case of knowledge objects like journal articles, data, conference proceedings, books, as well as videos, newsletters, presentation, reports, practice abstracts, booklet, and flyers had an exemplary performance on the Accessibility FAIR principles requirement.



Figure 22: Accessible module results; i. Accessible FAIR principles and ii. Accessible sub principles







Figure 23:Performance of knowledge objects on accessible principles

8.1.3 Interoperability of knowledge objects

The evaluation of knowledge objects showed that about 31% of performed poorly and 62% of the total knowledge objects performed on average on the Interoperable FAIR Principles requirement assessment. Only 6% of the total knowledge objects met the Interoperable FAIR principles requirement. Most of the knowledge objects performed poorly on the I3 and I2 sub principles. The majority of the knowledge objects do not make use of standard (meta)data vocabularies and fail to use knowledge representation languages and qualified references to other (meta)data. Knowledge objects like journal articles and software performed exemplary; apart from that, data, conference proceedings, books, practice abstracts performed higher than average.







Figure 24: Interoperable module results; i. Interoperable FAIR principles and ii. Interoperable sub principles



Figure 25: Performance of knowledge objects on interoperable principles

8.1.4 Reusability of knowledge objects

The results showed that about 75% of knowledge objects performed poorly on the assessment of the reusability dimension of the FAIR principles, whereas only 14% met this requirement. Most of the knowledge objects performed poorly on the R1.1 and R1 sub-principles. The main reason for this poor performance is the lack of clear information on the use of licenses which is missing in (meta)data. A similar pattern has been observed for knowledge objects like journal articles, software, tools, and a thesis that exemplifies reusable principles requirements.







Figure 26: Reusable module results; i. Reusable FAIR principles and ii. Reusable sub principles



Figure 26: Performance of knowledge objects on reusable principles

8.2 Overall FAIRness of the knowledge objects

The overall FAIRness of the data/knowledge objects to be considered as input for the EUREKA EU FarmBook repository has been measured. To do so, the four fundamental FAIR principles were grouped and assigned equal weights to analyse general compliance (See Figure 27). It has been





observed that about 22% of the knowledge objects meet all principles requirements. The Findable and Reusable principles have played a crucial role in the knowledge objects' overall performance. Based on these two FAIR principles, it has been realised that globally unique and persistent identifiers, metadata, and transparent information on the use of licenses in the (meta)data are crucial ingredients to achieve a high FAIRness by the knowledge objects.

The FAIRness evaluation of the knowledge objects has also shown that knowledge objects like journal articles, data, software, tools and thesis have higher FAIRness than others (Figure 28). In terms of adherence to the FAIR principles by the selected MAPs, three of them have had an exemplary performance by conforming to FAIR principles (Figure 29). These MAPs are TREASURE, Feed-a-Gene, and DiverFarming.



Figure 27: Overall FAIRness results











Figure 29: FAIR principles compliance selected MAPs

9 Recommendations

The European Commission's intention, together with the widely expressed desire of various stakeholder groups, is that the knowledge objects available from MAPs should remain available even after the completion of MAPs and follow the FAIR data principles. These knowledge objects are results of various activities and experiments undertaken in the MAPs and may potentially have a crucial role and contribution to further research, innovation, as well as be an essential resource





for making important decisions. The EUREKA project provides a platform in the form of EU FarmBook that facilitates a FAIR environment for the collected knowledge objects by building upon a FAIR design and technology infrastructure ecosystem enabling FAIR data services to the end-user. From the analysis performed, it has been observed that the heterogeneity of the MAP knowledge objects calls for further normalisation to achieve a higher FAIRness.

In the EUREKA project, we are exploring a number of components to ensure the effective integration of the FAIR data principles within the EUREKA EU FarmBook implementation. For this purpose, we are making a number of recommendations in regard to the implementation of the FAIR principles. These recommendations are based on the findings of the tasks carried out in EUREKA such as the nature of the existing MAPs, the types of knowledge objects, the quality of knowledge objects, the available technical ecosystems, and most importantly, the current research culture and practices in the Agri-Food domain.

In summary, we provide the highest priority recommendations that need to be considered in the EU FarmBook in order to implement FAIR data principles:

 Define FAIR for the EUREKA project: To make the EU FarmBook knowledge objects FAIR, it is necessary to incorporate and emphasise concepts that are implicit in the FAIR principles (i.e., data selection, long-term stewardship, accessibility, legal interoperability and sustainability of the EUREKA Data repository).

• Technical ecosystem for FAIR data principles in EU FarmBook:

- FAIR Digital Objects: Implementing FAIR in the EU FarmBook design requires a model for FAIR Digital Objects. Each knowledge object in the EU FarmBook should be accompanied by Persistent Identifiers (PIDs) and an essential, rich metadata set enabling humans and/or machine agents to easily find and retrieve it.
- Metadata: To increase the knowledge object's FAIRness in EU FarmBook, a rich metadata set will be provided together with the necessary documentation. One of the primary responsibilities of the EU FarmBook will be to have built-in metadata services. Metadata services will add additional metadata to ingested knowledge objects in the EU FarmBook repository, which will allow more detailed search queries and increase the findability and reusability of the knowledge objects. In addition to the above, there





will be also an intention to make the EU FarmBook knowledge objects' metadata available via publicly accessible registries/repositories to ensure availability during the course of time.

- Data standards, schemas, ontologies, and vocabularies: The EU FarmBook repository schema will be designed by drawing upon a wide range of schemas, ontologies, and vocabularies to increase the knowledge objects' findability, interoperability, and reusability. A first step towards this direction will be the utilisation of widely adopted semantic web technology standards like the RDF data model¹⁰ and the OWL Ontology Web Language¹¹. In addition to that, for the needs of metadata properties definition, existing and broadly adopted ontology components are intended to be reused. Such ontologies are schema.org¹², Dublin Core¹³, FOAF, FRAPO, as well as the RDFS data-modelling vocabulary¹⁴ and the SKOS model¹⁵. The intention of re-using components of the above-mentioned standards, ontologies and models is to achieve as good as possible fit with the FAIR principles.
- Trust and certification: To ensure end-user trust in the EU FarmBook repository and comply with the FAIR principles, one of the long-term aims of the EUREKA project will be to achieve the CoreTrustSeal (CTS) for EU FarmBook repositories.
- Data usage license: To ensure the reusability of knowledge objects, the EU FarmBook repository will maintain a clear and accessible data usage license (namely, Open Digital Rights Language (ODRL)^{16,} Creative Commons¹⁷, SPDX license registry¹⁸ Etc.) for every knowledge object in the EU FarmBook and include license information in the metadata.

¹⁸ <u>https://spdx.org/licenses/</u>



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¹⁰ <u>https://www.w3.org/TR/rdf-primer/</u>

¹¹ <u>https://www.w3.org/TR/owl-features/</u>

¹² https://schema.org/

¹³ <u>https://www.dublincore.org/specifications/dublin-core/dcmi-terms/</u>

¹⁴ <u>https://www.w3.org/TR/rdf-schema/</u>

¹⁵ <u>https://www.w3.org/TR/skos-primer/</u>

¹⁶ <u>https://www.w3.org/TR/odrl-model/</u>

¹⁷ <u>https://creativecommons.org/</u>



10 Conclusion

The main objectives of this report were to achieve the following:

- 1. To analyse data sets, knowledge objects and end-user needs in order to select data and knowledge objects to include in the EU FarmBook
- 2. Evaluate the (data) quality of knowledge objects from selected Multi-Actor projects based on FAIR data principles.

The work planned in Tasks 3.1 and 3.2 has been undertaken and is described in this report and can be summarised in the following activities:

- Analysis of results generated by WP1 (list of MA projects and knowledge objects) and WP2 (end-user needs) to select data and knowledge objects to include in the EU FarmBook
- Creation of five thematic expert working groups, selection of thematic experts, and a holding a series of online webinars with those selected
- Evaluation of data quality based on FAIR data principles

A ranked list of knowledge objects has been created, and a series of suggestions have been received from the experts involved in the webinar activities, which should be considered when selecting data and knowledge objects to include in the EU FarmBook. The most important ones regarded:

- Language barriers
- A tailormade search of information
- The repository's long-term sustainability
- The usability of the EU FarmBook on smartphones
- The importance of networking

In Task 3.2, we have also developed a set of recommendations, including recommended technical approaches for an integrated e-infrastructure to support the EUREKA / EU FarmBook approach. This technical approach would allow existing and future projects to easily share knowledge objects (data sets, documents, multimedia objects) in a consistent format ensuring ease of re-use. A number of recommendations regarding the implementation of the FAIR principles have been formulated within this deliverable. These recommendations also have to be considered within the





EUREKA EU FarmBook implementation to ensure the effective integration of the FAIR data principles.





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Annex I: Invitation letters



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Dear,

First of all, we hope our e-mail finds you in good health and safety.

We thank you for your interest in taking part in the Task 3.1 activity of the EUREKA project. Eureka - "EUROPEAN KNOWLEDGE REPOSITORY FOR BEST AGRICULTURAL PRACTICE" is a Horizon 2020 project (16 European Countries are involved) which aims to co-create a stronger EU wide agricultural knowledge database (repository) by analysing the variety of different outputs, activities and dissemination strategies of all Horizon 2020 projects based on the multi-actor approach.

This knowledge repository, which we call *the FarmBook*, will ensure the longevity and better sharing of the results and research outputs produced by Multi Actor Projects, in order to enhance the much wider, cross-sectoral and long-term use. You can find more information on the <u>website EUREKA</u>. In task 3.1 it is foreseen the involvement of experts, like you, to help us understand exactly what kind of data (knowledge objects) is useful and required in an open source e-platform that will also be tailored made for the end users (farmers, forester, advisors, policy makers etc.) in order to assist them in their everyday work. We think you can help us in determining which knowledge objects are most relevant to put in the platform.

As an expert you will take part of one of the Five thematic Working Groups created to facilitate the work of evaluation and assessment:

1) Arable and Horticultural Crops,

2) Perennial Crops (e.g. orchards, vineyard, olive grove...)

- 3) Forestry
- 4) Livestock and Dairy

5 Industrial Crops & Agri-food Industry (agro-industry dealing with processing of primary products (Wine, Extra Virgin Olive Oil, Milling Industry....).

We hope that **"Arable and Horticultural Crops"** (for example) could be the right Working Group for you. We have already done a mapping of 101 Multi Actor projects in order to get an overview of the knowledge outputs. Now we would like to know your opinion about these outputs and also understand if we can add something more to the list of requirements.

The participation is voluntarily, and it won't take away too much time from you. We would like you to participate in an interactive webinar (90 minutes), where we will discuss and fill in a short online questionnaire.

We would like to ensure you that your personal data will be managed according to the GDPR rules. Thank you very much in advance if you express your intention to participate by responding this email. Looking forward to hearing from you very soon

Best Regards



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Annex II: Webinar programs





Working Group: 3) Forestry 9th December 2020 time: 11:00 -12:30 Join the Zoom meeting: <u>https://zoom.us/j/98605157532?pwd=MjBBZE1QR05peUtFUThuYXU2TGZhUT09</u>

Webinar Program

•	Introduction	(3 min)
•	Short presentation of WP1 "MA [*] Knowledge Mapping and co-creating MA best pract (*Multi Actor projects)	t ices" (10 min)
•	Interactive moment on WP1 results with <i>Mentimeter</i> (to have the expert's op the most important/impactful knowledge objects and create a ranking list) & structured discussion.	inion on Open
		(20 min)
•	Short presentation of WP2 "Get to know the <i>FarmBook</i> end user"	(10 min)
•	Interactive moment on WP2 results with <i>Mentimeter</i> (to have the expert's op End users' requirements) & Open structured discussion.	(20 min)
•	Short presentation of e-platform "the FarmBook"	
•	Interactive moment on categorization of knowledge objects with <i>Mentimeter</i> and ro discussion regarding the FarmBook	(25 min)
•	Conclusions	(2 min)



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Working Group: 5) Agri-food 9th December 2020; time: 15:00 - 16:30

Join the Zoom meeting: https://zoom.us/j/91771306471?pwd=OWV1WGluOHQ5UnVRbG5ZVEFaSHIzZ209

Webinar Program

•	Introduction	(3 min)
•	Short presentation of WP1 "MA [*] Knowledge Mapping and co-creating MA best pract (*Multi Actor projects)	ices" (10 min)
•	Interactive moment on WP1 results with Mentimeter (to have the expert's op	inion on
	the most important/impactful knowledge objects and create a ranking list) & structured discussion.	Open
		(20 min)
•	Short presentation of WP2 "Get to know the <i>FarmBook</i> end user"	(10 min)
•	Interactive moment on WP2 results with <i>Mentimeter</i> (to have the expert's op End users' requirements) & Open structured discussion.	inion on (20 min)
•	Short presentation of e-platform "the FarmBook" Interactive moment on categorization of knowledge objects with Mentimeter and ro discussion regarding the FarmBook	und table
		(25 min)
		, ,,
•	Conclusions	(2 min)



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Working Group: 1) Arable and Horticultural Crop 10th December 2020 time: 11:00 -12:30 Join the Zoom meeting: <u>https://zoom.us/j/92202262847?pwd=anNJam9Ec0IBcGdoaTVyakx2MjlyZz09</u>

Webinar Program

•	Introduction	(3 min)
•	Short presentation of WP1 "MA [*] Knowledge Mapping and co-creating MA best pract (*Multi Actor projects)	tices" (10 min)
•	Interactive moment on WP1 results with <i>Mentimeter</i> (to have the expert's op the most important/impactful knowledge objects and create a ranking list) & structured discussion.	Open
		()
•	Short presentation of WP2 "Get to know the <i>FarmBook</i> end user"	(10 min)
•	Interactive moment on WP2 results with <i>Mentimeter</i> (to have the expert's op End users' requirements) & Open structured discussion.	Dinion on (20 min)
•	Short presentation of e-platform "the FarmBook"	
•	Interactive moment on categorization of knowledge objects with <i>Mentimeter</i> and ro discussion regarding the FarmBook	ound table
•	Conclusions	(2 min)

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Working Group: 4) Livestock and Dairy 15th December 2020 time: 11:00 -12:30 Join the Zoom meeting: <u>https://zoom.us/j/98042598047?pwd=cHIrWXJWeXNPV1RiVIVjNIZBMzVFdz09</u>

Webinar Program

•	Introduction	(3 min)
•	Short presentation of WP1 "MA [*] Knowledge Mapping and co-creating MA best pract (*Multi Actor projects)	t ices" (10 m in)
•	Interactive moment on WP1 results with <i>Mentimeter</i> (to have the expert's op the most important/impactful knowledge objects and create a ranking list) & structured discussion.	inion on Open
		(20 min)
•	Short presentation of WP2 "Get to know the <i>FarmBook</i> end user"	(10 min)
•	Interactive moment on WP2 results with <i>Mentimeter</i> (to have the expert's op End users' requirements) & Open structured discussion.	(20 min)
•	Short presentation of e-platform "the FarmBook"	und table
	discussion regarding the FarmBook	(25 min)
•	Conclusions	(2 min)



The EUREKA project has received funding from the European Union's Horizon







Working Group: 2) Perennial Crop 14th December 2020 time: 11:00 - 12:30 Join the Zoom meeting: <u>https://zoom.us/j/97720477216?pwd=OWI5di9DVjV3azMrdnpjZExKOGizZz09</u>

Webinar Program

•	Introduction	(3 min)	
•	Short presentation of WP1 "MA [*] Knowledge Mapping and co-creating MA best prace (*Multi Actor projects)	tices" (10 min)	
•	Interactive moment on WP1 results with Mentimeter (to have the expert's op	pinion on	
	the most important/impactful knowledge objects and create a ranking list) & Open structured discussion.		
		(20 min)	
•	Short presentation of WP2 "Get to know the <i>FarmBook</i> end user"		
		(10 min)	
•	Interactive moment on WP2 results with <i>Mentimeter</i> (to have the expert's op End users' requirements) & Open structured discussion.		
		(20 min)	
•	Short presentation of e-platform "the FarmBook"		
•	Interactive moment on categorization of knowledge objects with <i>Mentimeter</i> and round table discussion regarding the FarmBook		
		(25 min)	

Conclusions

(2 min)





Annex III: Webinar Forestry – Mentimeter results

























QUESTION 1.4			
to .			
10	policy guidelines		
databases, registers, publications	Access to exp. infrastructure		
2		•	

















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Annex IV: Webinar Industrial Crops&Agrifood Industry–Mentimeter results











































































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Annex V: Webinar Arable and Horticulture Crop – Mentimeter results



























QUESTION 1.4	W The divisor		
N	•		
Faznezs datasets		No, a good list in my opinion	
publications, databases, registers, regulations	all newest information (policy)	80	
		:	















15		feer other people's subtrace on	
		Disector	
200	-	autowatizatily factored to podepress	
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NO

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YES

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Annex VI: Webinar Perennial Crops – Mentimeter results



















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Annex VII: Webinar Livestock and Dairy – Mentimeter results

















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Annex VIII: FAIRness Assessment Framework

FAIR principles	FAIR-Sub principles	Test question	Description for score system (0-1)
Findable	F1: (meta)data are assigned a globally unique and persistent identifier	Do the knowledge objects have any identifiers assigned?	 025 : No identifier .2550: Web address (URL) .5075: Local identifier .75-1.: Globally Unique, citable and persistent identifier (e.g., DOI, PURL, ARK or handle)
	F2. data are described with rich metadata (defined by R1 below)	How are the knowledge objects described with metadata?	 025 : data is not described .2550: Brief title and description .5075: Comprehensively, but in a text- based, non-standard format .75-1: Comprehensively, using a recognised formal machine-readable metadata schema
	F3. metadata clearly and explicitly include the identifier of the data it describes	Do the metadata records contain the globally unique and persistent identifier for the knowledge objects?	025 : Never /NA .2550: If mandatory .5075: Sometimes .75-1 :Always
	F4. (meta)data are registered or indexed in a searchable resource.	How accessible is the (meta)data publicly?	 025 : No access to metadata or data .2550: Accessible through a local or internal system only .5075: Public, or accessible with permission .75-1 : Highly ranked in the general-purpose index

Accessible	A1: (meta)data is	Is the meta(data) available	025: No access to data
	retrievable by their	to the user using a defined,	.2550: Communication protocol not
	identifier using a	commonly used access	specified in the metadata
	standardised	protocol?	.5075: Requires some proprietary form
	communications		of communication
	protocol.		.75-1 : commonly used protocol such as
			HTTP or FTP



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, c i	A1.1: the protocol is open, free, and universally implementable	Is the protocol used to obtain the data free, open and universally implementable?	0: No 1: Yes
/ 2 2 1 1 1	A1.2:the protocol allows for an authentication and authorisation procedure, where necessary	Is the data public, or if the data is private is there some way to gain access if allowed to?	025 : Always .2550: Sometimes .5075: If mandatory .75-1 :Never
	A2. metadata is accessible, even when the data are no longer available.	Will the metadata be available even if the data is no longer available?	0: No 1: Yes

Interoperable	 I1: (Meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation. 	In what format is the (meta)data available?	 025: No access to data .2550: By individual arrangement .5075: Using standardised vocabularies/ontologies/tagging schemas without Non-standard web service .75-1 : Through a standard web service API
	I2: (Meta) data usevocabularies thatfollow FAIRprinciples	Do the meta(data) make use of standardised vocabularies?	 025: Not applicable .2550: Community standard labels vocabularies/ontologies/tagging schemas without Non-standard web service .5075: Some fields linked to externally managed definitions





		.75-1: All knowledge objects linked to globally standard managed definitions
I3: (Meta) data include qualified references to other (meta)data.	Are there extensive metadata and rich additional documentation available with knowledge objects?	 0: There are no links to metadata 1: Metadata includes links and references to other meta(data)

 550: Some description of the owledge object 075: Text-based, non-standard format 5-1: Comprehensively machine-
owledge object D75: Text-based, non-standard format 5-1: Comprehensively machine-
075: Text-based, non-standard format 5-1: Comprehensively machine-
5-1: Comprehensively machine-
adable metadata schema
.50: No information
075: Standard text-based licence
5-1: Standard license (e.g., Creative
ommons)
. 50: No information 075: Standard text-based licence 5-1: Standard license (e.g., Cre ommons)



R1.2: (Meta)data	Is it clear from the metadata	025: No description
are associated with	from which sources the data	.2550: Some description of the
detailed	was compiled or	knowledge object
provenance	transformed?	.5075: Text-based, non-standard format
[Same as R1]		.75-1: Comprehensively machine-
		readable metadata schema
R1.3: (Meta) data	Do the meta(data) use the	025 : No
meet domain-	Agri-food community	.5075: Somewhat
relevant	endorsed standards?	. 75-1 :Yes
community		
standards		

