Food Nutrition Security Cloud

Deliverable D8.1

FNS-Cloud Charter

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1 Publishable summary

The FNS-Cloud Charter includes the text that will be presented to the General Assembly to be adopted by the members of the Consortium in the context of this project. The relevant aspects of Open Science and the ethical values that underpin the text of the Charter are previously studied so they will allow the members to understand the reasons that ground the proposal.

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2 Introduction

As stated in FNS-Cloud proposal, the main objective of this project is to contribute to overcome the existent "infrastructure fragmentation by federating Food Nutrition Security (FNS) data essential for addressing diet, health, and consumer behaviour as well as on sustainable agriculture and the bio-economy". In this context, the general objective of WP8 is to "develop a sustainable Open Science and Open Innovation governance framework and sustainable business model for FNS-Cloud in accordance with EU requirements and needs of the project and user communities. The proposed structure and resulting documents of this WP serve as a guide to design the software underpinning FNS-Cloud architecture and integration, specifically governance, operations, and sustainability, adapted for daily working methodologies." WP8's general objective is planned to be documented in five deliverables due in M18 and M48. The first and second deliverables (M18) are related to the Open Science, Open Innovation and sustainability aspect of FNS-Cloud, while deliverables three to five (M48) will deal with business model, coherence between the ICT infrastructure and the Governance structure and a wrap up evaluation where the content of the final project will be analysed and where any needed update of the WP8 findings will be included, specially taking into account that we are in an initial phase of the EOSC development and that many of its steps are still to be performed.

Within WP8, the designed tasks began with a literature review to update our understanding of the concepts of Open Science and Open Innovation (T8.1), terms which semantic content has yet to solidify in the ICT (Information and Communication Technologies) ways of producing Science. After the appearance of ICT, the existence of new devices and facilities has triggered an extraordinary change in the way we share knowledge. What we understand by Open Science is being the subject of a long discussion not only among academics but also in the documentation published under the auspices of the European Commission (EC) and very recently under UNESCO. Further tasks in WP8 have been T8.2 and T8.3, respectively titled "Corporate ethics for FNS-Cloud governance" and "Sustainability", which with T8.1 provides us with the fundamentals for this deliverable, FNS-Cloud Charter, a strategic position paper as the basis for a sustainable entity, which is included and proposed in the final section of this document.

In summary, the content of this deliverable includes the relevant aspects regarding the concept of Open Science, ethical values and sustainability, this last item understood in the sense of the United Nations' (UN) Sustainable Development Goals (SDGs) and not in the sense of economic sustainability within the European Open Science Cloud (EOSC), meaning that is subject of analysis in D8.2, "Report on FNS-Cloud Sustainability".

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3 Open Science

3.1 Open Science definition and contents

There is not a common definition of Open Science. According to certain authors, "if it is not open, it is not science"[1], therefore, to use together the terms *open* and *science* is a pleonasm. According to others, the definition is very simple: it consists in "showing the work one does in science" (Lafuente and Alonso, 2011, p. 40). The approach taken by the EOSC Executive Board to define Open Science in their publication "Strategic Research and Innovation Agenda (SRIA) of the European Open Science Cloud (EOSC)" (SRIA from now on) has been to quote the Wikipedia and the FOSTER (Facilitate Open Science Training for European Research) project. According to Wikipedia, Open Science is

> […] the movement to make scientific research (including publications, data, physical samples, and software) and its dissemination accessible to all levels of an inquiring society, amateur or professional. […] Open science is transparent and accessible knowledge that is shared and developed through collaborative networks. It encompasses practices such as publishing open research, campaigning for open access, encouraging scientists to practice open-notebook science, and generally making it easier to publish and communicate scientific knowledge. (EOSC Executive Board, 2021, p. 21).

And according to the FOSTER project, "Open Science is about extending the principles of openness to the whole research cycle [...], fostering sharing and collaboration as early as possible thus entailing a systemic change to the way science and research is done." (*ibidem*).

Under the FOSTER thesis, the concept of Open science is composed of four core elements: open access to scholarly outputs, open data, open source and open reproducible research (Pontika *et al*, 2015). Notwithstanding the authority of the FOSTER project in relation to Open Science, other European projects have included extra components. For example, AGINFRA+ project (AGINFRA PLUS - Accelerating user-driven e-infrastructure innovation in Food Agriculture) completes the initial four components with (5) Open peer-review, (6) Open science policies, (7) Open funding, (8) Open science evaluation, (9) Open science tools and (10) Open education (AGINFRA+, 2017). As per this project, Open Science involves the following transformations, some of which are still to be developed:

- From open access to open science. Open access and open data models are quickly being transformed into open science practices that affect the whole ecosystem of producing, communicating and re-using research results.
- From human-readable to machine-readable content. Machine readability of the content is now at least as important as human readability as it facilitates the automated harvesting, text mining and re-use of content.

1 Eva Méndez (Chair of the Open Science Policy Platform, Mandate 2) in a personal interview with the author.

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- From open data to data re-use. Implementation of technologies that integrate structured data into the narrative to the highest possible degree.
- From traditional publishing to technology-driven service. Technological innovations become critical for the proper publishing and dissemination of scientific content.
- From semantic enrichment of content to semantic publishing. Semantic tagging and enrichment of content is seen as a transitional step towards the next stage of transformation of content into Linked Open Data (LOD). (AGINFRA+, 2017)

3.2 Open versus close

To understand what is meant by the term *open* it is useful to point out that it was not until the sixteenth and seventeenth centuries when the conception of science as "public knowledge" took form. Prior to that time, science was considered a debate between separate schools in classical Greece or conditioned by a "rigid social hierarchy and by a political and religious outlook that encouraged withholding the secrets of nature from the vulgar" (Eamon, 1986, p. 321) during the Middle Age. And even after science was understood as "public knowledge", there has been a permanent debate in science over the balance between secrecy and openness. The arguments in favour of keeping secrets may come from outside the scientific community, as for example in military[2] and industrial research, but also from within scientists, due to the desire for priority of discovery, or the desire to carry the research undisturbed (*idem* p. 347). What is clear since classical Greece is that although knowledge is best transmitted through openness, the tension between open and close remains. Science was still known as science *per se*, without the need of the adjective *open*.

The main characteristics of modern science were theorized in 1942 by the sociologist Robert K. Merton in his "The Normative Structure of Science" (Merton, 1973, p. 267-278). For Merton, "The ethos of science is that affectively toned complex of values and norms which is held to be binding on the man of science" (*idem*, pp. 268-269), legitimatized in terms of institutional imperatives which represent the values of science. These values were four:

- Universalism. Science is not subject to nationalisms: "Universalism finds immediate expression in the canon that truth-claims, whatever their source, are to be subjected to preestablished impersonal criteria" (*idem* p. 270).
- "Communism".[3] Merton explained that this term must be understood as "the nontechnical and extended sense of common ownership of goods" (*idem* p. 273). And most importantly, asserted that "The institutional conception of science as part of the public domain is linked

2 See Galison, P. (2004) "Removing Knowledge." *Critical Inquiry*, vol. 31, no. 1, 2004, pp. 229–243. *JSTOR*, www.jstor.org/stable/10.1086/427309 concerning the scientists' self-censorship on matters related to the atom nucleus in the 'Manhattan Project', which lead to the invention of the atomic bomb.

3 Quotes are included in the original text.

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with the imperative for communication of findings. Secrecy is the antithesis of this norm; full and open communication its enactment" (*idem* p. 274).

- Disinterestedness. Institutions where science is produced enjoin disinterested activity (*idem* p. 276).
- Organized Skepticism. This characteristic is both a methodological and an institutional mandate and consists in a "temporary suspension of judgement and the detached scrutiny of beliefs in terms of empirical and logical criteria" (*idem* p. 277).

Merton's second characteristic, "communism", is linked to the transmission of science: "The institutional goal of science is the extension of certified knowledge" (*idem*, p. 270). He asserted that "The communism of the scientific ethos is incompatible with the definition of technology as 'private property' in a capitalistic economy", producing a conflict that has been resolved by scientists through patenting their results for public use, promoting new economic enterprises and through socialism advocation. Merton stated that there is a discrepancy on the conception of intellectual property between two different groups: "those which demand economic returns for scientific discoveries and those which demand a change in the social system to let science get on with the job" (*idem* p. 275). What we are witnessing here is the traditional 'open versus closed' tension, this time under a new face. It is not the will of the scientists what closes knowledge, but the default rule of intellectual property laws. By their application, if an activity is not specifically allowed by the intellectual work rightsholder, then it is prohibited. Thus, the default rule is closeness.

In this century, intellectual rules applicable to science had not changed, and the new way of science dissemination through the Internet was universal. On the 14th of February 2002, a group of persons involved in scholar publishing, worried about scientific dissemination, promoted the Budapest Open Access Initiative[4] (Chan *et al*, 2002). This declaration was to be followed by two other declarations: the Bethesda Statement on Open Access Publishing[5] (20th June 2003) and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities[6] (22nd October 2003). The three declarations addressed the difficulties faced by the dissemination of knowledge, surprisingly in the Internet era where access to information is promiscuous. As the Budapest Open Access Initiative declared in its first paragraph:

> An old tradition and a new technology have converged to make possible an unprecedented public good. The old tradition is the willingness of scientists and scholars to publish the fruits of their research in scholarly journals without payment, for the sake of inquiry and knowledge. The new technology is the internet. The public good they make possible is the world-wide electronic distribution of the peer-reviewed journal literature and completely free and unrestricted access to it by all scientists, scholars,

4 https://www.budapestopenaccessinitiative.org/read

5 https://openaccess.mpg.de/Berlin-Declaration

6 http://legacy.earlham.edu/%7Epeters/fos/bethesda.htm

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> teachers, students, and other curious minds. Removing access barriers to this literature will accelerate research, enrich education, share the learning of the rich with the poor and the poor with the rich, make this literature as useful as it can be, and lay the foundation for uniting humanity in a common intellectual conversation and quest for knowledge.

The three declarations, Budapest, Bethesda and Berlin served as foundational cornerstones for the Open Access movement. Ten months after the Budapest declaration (16th December 2002), Creative Commons, a North American foundation, published the Creative Commons Licences[7] which serve as a tool to declare publicly what are the activities that the author allows the public to exercise over a work. Through the expression of permissions in a licence attached to the work, the default closeness of the creation is avoided. The importance of these licences has been clear since their publication. As an example of their relevance, we can mention that the European Commission recommends using Creative Commons licences as the default ones in the "General Model Grant Agreement of the Horizon Europe (HORIZON) Euratom Research and Training Programme (EURATOM)".[8]

We cannot finish this section without mentioning the work of Charlotte Hess and Elinor Ostrom, this last author awarded with the Nobel prize for her studies on the common goods. In their seminal paper regarding *information as a common pool resource* (Hess and Ostrom, 2003), they summarized "the lessons learned from a large body of international, interdisciplinary research on common-pool resources in the past twenty-five years and consider its usefulness in the analysis of scholarly information as a resource". According to these authors, the right to own information is composed by a set of rights that must be analysed one by one. One of the key points studied in their article was to check which of the aspects related to intellectual property rights were relevant for researchers:

> Property rights define actions that individuals can take in relation to other individuals regarding some-"thing." If one individual has a right, someone else has a commensurate duty to observe that right. Schlager and Ostrom identify five major types of property rights that are most relevant for the use of common-pool resources, including access, extraction, management, exclusion, and alienation. These are defined as:
>
> **Access**:[9] The right to enter a defined physical area and enjoy non subtractive benefits (e.g., hike, canoe, sit in the sun).
>
> **Extraction**: The right to obtain resource units or products of a resource system (e.g., catch fish, divert water).

7 See press release: https://creativecommons.org/2002/12/16/creativecommonsunveilsmachinereadablecopyrightlicenses/

8 See pages 107 and 108 of the draft version 1.0 https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/common/agr-contr/general-mga_horizon-euratom_en.pdf

9 Emphasis added.

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> **Management**: The right to regulate internal use patterns and transform the resource by making improvements.
>
> **Exclusion**: The right to determine who will have access rights and withdrawal rights, and how those rights may be transferred.
>
> **Alienation**: The right to sell or lease management and exclusion rights. (Hess & Ostrom, 2003).

Therefore, when dealing with information, the concept of ownership does not constitute a monolithic right but is a polymorphic frame where different aspects must be considered. As an example, we may pose the Wikipedia case: It is not relevant who owns Wikipedia since everybody has the right to copy it, print and distribute commercially these copies, disseminate it, extract the database, split it, modify the contents, set up a proxy server, etc. Hence, when arriving at the digital realm, we should consider not only the ownership of results, but we should analyse if we should focus on the allowed activities the researchers may need to execute within a third-party scientific information. As Unger puts it:

> An advantage of the unified property right is that it allows a risk-taking entrepreneur to do something in which no one else believes without having to avoid potential vetoes by multiple stakeholders. Its disadvantage is the reverse side of this benefit. It fails to provide a legal setting for the superimposition of stakes of different kinds, held by multiple stakeholders, in the same productive resources. For that use, we need fragmentary, conditional, or temporary property rights, resulting from the disaggregation of unified property (Unger, 2019).

The ideas of Hess and Ostrom lead to understanding scholarly information a crucial component of science, as a common good, based on the possibility to disaggregate the traditional unified property into the five major rights identified by both authors: access, extract, manage, exclude and alienate. Supporting this approach, the EOSC Association states in the landing page of their website the following:

> The EOSC Association was established as a legal entity on 29th July 2020 with four founding members: GÉANT, CESAER, CSIC and GARR. The Association will sign a Memorandum of Understanding with the European Commission to progress the EOSC partnership, which will bring together all relevant stakeholders to co-design and deploy a European Research Data **Commons**[10] where data are findable, accessible, interoperable and reusable (FAIR), and also as open as possible.

To summarize this section, the tension between science and secrecy has been permanent through ages. In the digital age, one of the barriers to share scientific information is created by the application of intellectual property laws. To avoid this problem, the strategy has consisted in the adaptation of the property rights to the digital realm, fragmenting them into uses that may be

10 Emphasis added.

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transferred. In this way, we have evolved from the more generic Mertonian term “communism” into the specific Hess and Ostrom’s term “commons”, or common goods.

3.3 Open Science in the European Union

3.3.1 Steps towards the EOSC

The initiatives on Open Access made their way through to the European Commission. On 14th February 2007, the Commission adopted a “Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee on scientific information in the digital age: access, dissemination and preservation {SEC(2007)181}” (European Commission, 2007) where it was recognised that:

> An important recent trend has been the development of the open access movement, based on the viewpoint that access to publications and data should be improved in the Internet age. This movement aims to ensure immediate and free Internet access to research publications. A key milestone within this movement is the 2003 Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities.

Five years later, after accepting that an EU action was needed to implement these ideas, on the 17th of July 2012, the EC published a press release[11] where they announced measures to improve access to scientific information produced in Europe. The first step, according to the EC, was to make open access to scientific publications a general principle of Horizon 2020 funding programme. The same day the EC published two documents related to the press release: the first one was entitled “Commission Recommendation of 17.7.2012 on access to and preservation of scientific information” C(2012) 4890 final (European Commission, 2012a), and the second one was the “A Reinforced European Research Area Partnership for Excellence and Growth” (COM(2012) 392 final) (European Commission, 2012b). The aim of the first communication was to improve access to scientific information, while the aim of the second one was to develop a European Research Area (ERA).

Regarding the access to research information, whereas (6) of the first document stated that open access would improve scientific research:

> Policies on open access to scientific research results should apply to all research that receives public funds. Such policies are expected to improve conditions for conducting research by reducing duplication of efforts and by minimising the time spent searching for information and accessing it. This will speed up scientific progress and make it easier to cooperate across and beyond the EU. Such policies will also respond to calls within the scientific community for greater access to scientific information.

11 https://ec.europa.eu/commission/presscorner/detail/en/IP_12_790

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And related to the Commission aim to develop a European Research Area (ERA) the COM (2012) 392 final mentioned that:

> In view of open innovation and the increasingly collaborative nature of science, completing ERA also means realising the 'fifth freedom'- free circulation of researchers and scientific knowledge, including via digital means. The following definition of ERA is based on the Lisbon Treaty and European Council Conclusions: a unified research area open to the world based on the Internal Market, in which researchers, scientific knowledge and technology circulate freely and through which the Union and its Member States strengthen their scientific and technological bases, their competitiveness and their capacity to collectively address grand challenges.

Between July and September 2014, the European Commission held a public consultation on what was called Science 2.0. The objective of this action was to gather the opinions of stakeholders related to three aspects: (1) their awareness of the changing modus operandi to produce science, (2) the perception of the opportunities and challenges and (3) the identification of "policy implications and actions to strengthen the competitiveness of the European science and research system by enabling it to take full advantage of the opportunities offered by Science 2.0."[12] The result of the consultation was published in February 2015 under the name "Validation of the results of the public consultation on Science 2.0: Science in Transition" (European Commission, 2015) and one of its most visible outcomes was to change the term "Science 2.0" for "Open Science". The document stated:

> 2.1. From Science 2.0 to Open science
>
> The results of the consultation suggest that many stakeholders prefer using an alternative term to 'Science 2.0'. 'Open science' appeared to be the most popular alternative term. It was selected from among six options by 43% of respondents and discussed during the workshops as the most viable alternative.
>
> Other suggestions made by questionnaire respondents included 'participatory science', 'science highway', 'better science', 'open research' and 'open scholarship' – the latter two were included as alternatives to the word 'science', which could be interpreted as excluding the humanities in some cultural contexts.
>
> In this document, we will use the term 'Open science' from this point forward. (*idem*, p. 6).

The participants were also asked to define what they understood by Open Science, and the result was again a plural number of components:

> 2.2 The concept of Open science

12 See https://ec.europa.eu/digital-single-market/news/final-report-science-20-public-consultation

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> In position statements, stakeholders emphasised that Open science refers to multiple, related developments. For instance, LERU described it as 'an umbrella term for a series of movements in research'. Science Europe said it is a 'series of related practices' and the Public Library of Science (PLOS) said it is a 'system of related changes that must be considered in relation to one another'.
>
> Science Europe identified three essential aspects of Open science: its relation to digital technology, the idea that it explores changing research practices and their impact on the research system as a whole, and the fundamental importance of "a certain vision of science as a community of practice". (*idem*, p. 6).

One year after the publication of the before mentioned consultation, the Netherlands' EU Presidency hosted on the 4 and 5 April 2016 in Amsterdam the conference 'Open Science – From Vision to Action'[13] with the participation of experts and stakeholders. The report of the conference was published under the title "Amsterdam Call for Action on Open Science" (Netherlands, 2016) and included the following statement:

> Open science is about the way researchers work, collaborate, interact, share resources and disseminate results. A systemic change towards open science is driven by new technologies and data, the increasing demand in society to address the societal challenges of our times and the readiness of citizens to participate in research.

The document proposed two pan-European goals for 2020: Full open access for all scientific publications and a new approach towards optimal reuse of research data. For that to happen, a twofold policy was needed: (1) a new assessment, reward and evaluation systems and (2) Alignment of policies and exchange of best practices.

Since 2016, it is evident that the European Commission (EC) has clearly chosen the openness path. Not without difficulties (Burgelman, J. C., 2021), the policies suggested by the "Amsterdam Call for Action" were solidified in the "Communication from the commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. European cloud initiative -building a competitive data and knowledge economy in Europe. COM (2016) 178 final" (European Commission, 2016). In its communication, the EC proposed the creation of the European Open Science Cloud (EOSC), based on the federation of existing scientific data infrastructures scattered in that time across disciplines and Member States. For this purpose, the communication asserted that "to develop the European Open Science Cloud it will be necessary to: Make all scientific data produced by the Horizon 2020 Programme open by default […]" (*idem*, p. 6).

Two years later, the EC published the "Commission Staff Working Document. Implementation Roadmap for the European Open Science Cloud SWD(2018) 83 final" (European Commission, 2018) where again openness was the rule. Furthermore, the EC and has developed the EOSC, has been providing tools to build an open access platform, announced in the "Information Note towards a

13 See https://www.government.nl/documents/reports/2016/04/04/amsterdam-call-for-action-on-open-science

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Horizon 2020 platform for open access" (European Commission, 2017), and has been mandating publications to study what we should understand by Open Science and how to remove the barriers that remain. The recent "Progress on Open Science: Towards a Shared Research Knowledge System. Final Report of the Open Science Policy Platform" (Méndez *et al*. 2020) provided the update of the last four years mandate (2016-2020). While this report does not propose a definition of Open Science nor Open Innovation, nevertheless it proposes five attributes to be accomplished by a "Research System based on shared knowledge by 2030", which in synthesis is the final goal of the EOSC development:

> Attribute 1: An academic career structure that rewards a broad range of outputs, practices and behaviours to maximise contributions to a shared research knowledge system.
>
> Attribute 2: A research system that is reliable, transparent and trustworthy.
>
> Attribute 3: A research system that enables innovation.
>
> Attribute 4: A research culture that facilitates diversity and equity of opportunity.
>
> Attribute 5: A research system that is built on evidence-based policy and practice.

3.3.2 The EOSC projects position papers.

Open Science, thus, is not only a concept but it needs to be developed in practice.

As mentioned in a previous section of this deliverable, the SRIA report contains a section on Open Science. One of the inputs that the EOSC Executive Board considered for the SRIA comes from the compilation it made in December 2019 of five position papers from ESFRI cluster projects regarding their views about EOSC (Gotz *et al*., 2020) and by the projects funded under the INFRAEOSC-5[14] call, a group that includes five projects, the four regional ones plus the thematic project ExPaNDS (Drago *et al.*, 2020). The two compiled documents summarize the posture of ten projects participating in the development of EOSC and their content answered the three main questions posed by the Executive Board: (1) What does the project expect from the future EOSC, (2) what the project contributions to EOSC are and (3) which are the recommendations and key messages the project would provide for the governance of the future EOSC.

Although the group of respondents do not cover the diversity of the scientific domains subject of EOSC projects (see list in Appendix I), they do provide a consensus on the connexion between Open Science, governance and national policies. The answer of the regional projects may be summarized in the following points:

- EOSC-Nordic recommends to "Identify and map the open science policies & resource provisioning principles applied in the Nordic and Baltic countries", to "Identify current and

14 https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/infraeosc-05-2018-2019

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potential legal hurdles associated with the sharing of data and resources across national borders" and to "Discuss and coordinate policy activities, and advise on directions the national initiatives should take to align with relevant EOSC policies". (Drago *et al*., 2020, p. 7).

- EOSC-Pillar states that "Science does not stop at national borders. Therefore, from a policy perspective, we plan to help harmonise and improve the national policies and strategies related to FAIR data and Open Science, not only in our five countries, but also with the other European regions, and international partners worldwide". (*idem* p. 10).
- EOSC-Synergy: "EOSC should boost the transparency on its governance structures and procedures. Researchers already face their respective national policies, structures and procedures. EOSC should consider the simplicity and transparency as part of the clear added value of EOSC for the research community." (*idem* p. 14).
- NI4OS-Europe: "At policy level, actions that support the creation, development and inclusion of national Open Science Cloud initiatives into EOSC governance holds a key role. Governance structures on national level are crucial, they should be inclusive, and they should be comparable and provide coherent per-country involvement in pan-European governance." (*idem* p. 19).

Open Science needs governance, that must be built in different layers. It must include Member States but also a pan-European viewpoint. It must take into account both the possibility of building it through a bottom-up or top-down approaches, as the case may be more consistent with specific needs, as envisioned by EOSC-Pillar (*idem* p. 11), ExPaNDS (*idem p.* 23) and PaNOSC (Gotz *et al*., 2020, p. 21).

3.3.3 FNS-Cloud position

FNS-Cloud position regarding Open Science is to embrace the programmatic lines already shown by the EOSC Executive Board and the projects before mentioned. The leaders of the scientific, technical and dissemination work packages were interviewed in the preparation of this deliverable requesting their views on sustainability of FNS-Cloud and its relationship with EOSC, the difficulties they face to apply the principles on which Open Science is based (for example, FAIR data), and the challenges FNS-Cloud will face after its termination in month 48. The alignment of the WP leaders with Open Science principles poses no doubts, being financial sustainability and future need of resources the key challenges that should be explored in this stage of the project.

FNS-Cloud governance model will be studied in tasks T8.4, T8.5 and will be documented in deliverables D8.3 and D8.5 (all of them M19-48). During this period, they will be analysed in accordance with the values that must guide the project, which we detail in Section 4 of this document, 'Ethical values for FNS-Cloud governance'.

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3.4 Open Science goes global: UNESCO Recommendation

Dated 7th August 2019, the Executive Board of the UNESCO (United Nations Educational, Scientific and Cultural Organization) presented a consolidated Roadmap towards a possible Recommendation on Open Science.[15] After the studies facilitated by an internal multisectoral UNESCO Open Science Team, an Open Science Partnership and an Open Science Advisory Committee, a "draft of the UNESCO Recommendation on Open Science" was published on the 30th September 2020[16] (UNESCO, 2020). It contains a descriptive explanation of what to understand under the term Open Science and what are its components. According to the UNESCO:

> The term 'Open Science', refers to an umbrella concept that combines various movements and practices aiming to make scientific knowledge, methods, data and evidence freely available and accessible for everyone, increase scientific collaborations and sharing of information for the benefits of science and society, and open the process of scientific knowledge creation and circulation to societal actors beyond the institutionalized scientific community. (UNESCO, 2020, p. 4).

The key elements related to Open Science are, according to this document, (1) Open Access, (2) Open Data, (3) Open Source/Software and Open Hardware, (4) Open Science Infrastructures, (5) Open Evaluation, (6) Open Educational Resources, (7) Open Engagement of Societal Actors, and (8) Openness to Diversity of Knowledge (*idem,* pp. 4-6). Referred to the tension openness-secrecy, item 10 of the draft recommendation draws the boundaries between both concepts, taking side in favour of openness:

> 10. Scientific outputs should be as open as possible, and only as closed as necessary. Open Science affords necessary protection for sensitive data, information, sources, and subjects of study. Proportionate access restrictions are justifiable based on national security, confidentiality, privacy and respect for subjects of study. This includes legal process and public order, trade secrets, intellectual property rights, personal information and the protection of human subjects, of sacred indigenous knowledge, and of rare, threatened or endangered species. Some research results, data or code that is not opened may nonetheless be made accessible to specific users according to defined access criteria made by local, national or regional pertinent governing instances. The need for restrictions may also change over time, allowing the data to be made accessible at a later point. Open Science reflects the need to respect protections and the right of communities and nations to preserve the use and development of their knowledge and traditions, and to do so proportionately.

15 https://unesdoc.unesco.org/ark:/48223/pf0000369699.locale=en

16 See announcement at https://en.unesco.org/news/milestone-unescos-development-global-recommendation-open-science

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The most likely UNESCO's agenda will adopt the Recommendation on Open Science in their next General Conference, to be held in Paris in November 2021 and launch the Recommendation at the World Science Forum in South Africa (to be confirmed)[17]. If the draft is approved, we will have a comprehensive official text regarding Open Science and its constitutive parts, which will serve as a guide for the immediate and not so close future.

17 See "Next steps" section (page 4) in the minutes of the third meeting of the UNESCO Open Science Advisory Committee, held on the 30 November 2020:
https://en.unesco.org/sites/default/files/3rd_advisory_committee_report.pdf

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4 Ethical values for FNS-Cloud governance

4.1 UNESCO Open Science core values

FNS-Cloud T8.2. consisted in a "selection of values that would ensure coherence between results and the needs of user communities (i.e. integrity, responsibility, respect, honesty, equality, realism, efficiency, perseverance and rationality)". Nevertheless, the publication of the "draft of the UNESCO Recommendation on Open Science" (UNESCO, 2020) has eased our labour due to the content of section III of the text, entitled "Open Science Core Values and Guiding Principles", that will serve us as a perfect guidance for FNS-Cloud Charter and avoids to 'reinvent the wheel'. We transcribe items 15 and 16 of the draft:

> 15. The core values of Open Science stem from the ethical, epistemological and socio-technological implications of opening science to society and broadening the principles of openness to the whole cycle of scientific research. They include:
>
> (i) **Collective Benefit**[18]: as a global public good, Open Science belongs to humanity in common and benefits humanity as a whole;
>
> (ii) **Equity and Fairness**: Open Science should play a significant role in ensuring equity among researchers from developed and developing countries, enabling fair and reciprocal sharing of scientific inputs and outputs and equal access to scientific knowledge to both producers and consumers of knowledge regardless of geography, gender, ethnicity or socio-economic circumstances;
>
> (iii) **Quality and Integrity**: Open Science should support high quality research by bringing together multiple sources of knowledge and making research methods and outputs widely available for rigorous review and scrutiny;
>
> (iv) **Diversity**: Open Science should embrace a diversity of practices, workflows, languages, research outputs and research topics that support the needs and epistemic pluralism of diverse research communities, scholars, knowledge holders and social actors from different countries and regions;
>
> (v) **Inclusiveness**: In the common pursuit of new knowledge, Open Science should meaningfully engage the whole scientific community, as well as the wider public and knowledge holders beyond the institutionalized scientific community, including indigenous peoples and other traditional communities, engages the scientific community as a whole, as well as the wider public and knowledge holders.

18 Emphasis as in the original text.

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16. The following guiding principles for Open Science provide a framework for enabling conditions and practices within which the above values are upheld, and the ideals of Open Science are made a reality:

(a) **Transparency, scrutiny, critique and verifiability**: increased openness in all stages of the scientific endeavour enhances the societal impact of science and increases the capacity of society as a whole to solve complex interconnected problems. Increased openness leads to increased transparency and trust in scientific information and reinforces the fundamental feature of science as a distinct form of knowledge based on evidence and tested against reality, logic and the scrutiny of scientific peers. It is important to reaffirm, for a globally interdependent world, with new technologies, the epistemological scepticism, which is the foundation of Open Science and the source of its success.

(b) **Equal opportunities and access**: all researchers and societal actors regardless of country of origin, gender, field of research, funding basis, or career stage have an equal opportunity to contribute to and benefit from Open Science. Research outputs should be open by default, with immediate and machine-readable access in open formats to content, metadata and usage statistics, subject to constraints of safety, security and privacy.

(c) **Respect, responsibility and accountability**: with greater openness comes greater responsibility for all Open Science actors, which, together with accountability and respect forms the basis for good governance of Open Science.

(d) **Collaboration, participation and inclusion**: collaborations at all levels of scientific process, beyond the boundaries of geography, language, generations, disciplines and resources, should become the norm, together with the full and effective participation of societal actors and inclusion of excluded and marginalized knowledge in solving problems of social importance.

(e) **Flexibility**: due to the diversity of science systems, actors and capacities across the world, as well as the evolving nature of supporting information and communication technologies, there is no one-size fits all way of practicing Open Science. Different pathways of transition to and practice of Open Science need to be encouraged while upholding the above-mentioned core values and maximizing adherence to the other principles hereby presented.

(f) **Sustainability**: to be as efficient and impactful as possible, Open Science needs to build on sustainable practices, services, infrastructures and funding models that ensure the equal participation of scientific producers from less privileged institutions and countries. Open Science infrastructures should be

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non-profit, and they should guarantee permanent and unrestricted access to all public.

4.2 Other values

Notwithstanding the content of UNESCO's recommendation draft, there are further ethical aspects that should be considered. We refer to science as a human right, the special position Europe holds when privacy is concerned and the social and political aspects of technology.

4.2.1 Science as a human right

Regarding the first item, science as a human right, it is relevant to remember the legal nature of the right to enjoy the benefits of scientific progress, as it has a twofold impact in FNS-Cloud: it guides the positive action of all public and private organisation where scientific activities are held and, simultaneously, it provides a sphere where any decision against its application is forbidden. The content of this right cannot be subject to limitations except in case of tension with another right of the same hierarchy, that is, another fundamental right. We find applicable to FNS-Cloud context the following articles of human rights treaties:

Article 27 of the Universal Convention of Human Rights (United Nations).

> (1) Everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits.
>
> (2) Everyone has the right to the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author.

Article 15 of the International Covenant on Economic, Social and Cultural Rights, New York, 16 December 1966 (United Nations).

> 1. The States Parties to the present Covenant recognize the right of everyone:
>
> (a) To take part in cultural life;
>
> (b) To enjoy the benefits of scientific progress and its applications;
>
> (c) To benefit from the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author.
>
> 2. The steps to be taken by the States Parties to the present Covenant to achieve the full realization of this right shall include those necessary for the conservation, the development and the diffusion of science and culture.
>
> 3. The States Parties to the present Covenant undertake to respect the freedom indispensable for scientific research and creative activity.

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> 4. The States Parties to the present Covenant recognize the benefits to be derived from the encouragement and development of international contacts and co-operation in the scientific and cultural fields.

Article 13 of the Charter of Fundamental Rights of the European Union. 2012/C 326/02.

> Freedom of the arts and sciences
>
> The arts and scientific research shall be free of constraint. Academic freedom shall be respected.

Even though it is not legally binding, it is interesting to include here the Joint Appeal for Open Science[19] launched by the UNESCO, WHO, CERN and the Office of the United Nations High Commissioner for Human Rights due to the COVID-19 pandemic. In the text, they "reaffirm the fundamental right to enjoy the benefits of scientific progress and its applications and advocate for open, inclusive and collaborative science".

4.2.2 A special concern for privacy

European Union and the Council of Europe are demonstrating a special concern for privacy apropos ICT. The former protects privacy through the EU Charter of Fundamental Rights (European Union, 2000) and the General Data Protection Regulation (GDPR) 2016/679 (European Union, 2018), the latter through the Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data (CETS No. 108).[20] FNS-Cloud is fully in compliance with the values that underpin these legal texts. Furthermore, FNS-Cloud has already submitted Deliverable D9.2, about personal data protection, where it states that:

> D9.2: All data utilised and / or collected within the project FNS-Cloud will handled in accordance with specified European data regulations such as General Data Protection Regulation ('GDPR'), which regulates the processing by an individual, a company or an organisation of personal data relating to individuals in the EU. This document outlines the underlying principles and approaches that will be applied with FNS-Cloud, with respect to the processing, analysis and/or storage of any personal data.

As recent literature demonstrates after global scandals related to privacy issues (Cambridge Analytica is the paradigmatic case), the effects on not respecting privacy affect not only to the individuals but to democracy in full. Scholars as Shoshana Zuboff and Carissa Véliz have connected personal control to a new form of surveillance capitalism (Zuboff, 2019), and demonstrated the unethical behaviour of personal data business and how these companies undermine freedom, equality and democracy (Véliz, 2020). Therefore, there is a direct bottom-up connection between managing personal data and being able to predict or manipulate personal behaviours. Once the

19 https://en.unesco.org/sites/default/files/joint_appeal_for_open_sciences_fin_en_fin_0.pdf
20 http://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/108

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personal profiling has been done, the 'fake news' phenomena can be used to channel political choices.

4.2.3 Principles of research integrity.

FNS-Cloud has also submitted Deliverable D9.1, about research integrity. The principles regarding this activity were published by ALLEA (All European Academies) in 2017 and are as follows:

> Good research practices are based on fundamental principles of research integrity. They guide researchers in their work as well as in their engagement with the practical, ethical and intellectual challenges inherent in research. These principles are:
>
> • Reliability in ensuring the quality of research, reflected in the design, the methodology, the analysis and the use of resources.
>
> • Honesty in developing, undertaking, reviewing, reporting and communicating research in a transparent, fair, full and unbiased way.
>
> • Respect for colleagues, research participants, society, ecosystems, cultural heritage and the environment.
>
> • Accountability for the research from idea to publication, for its management and organisation, for training, supervision and mentoring, and for its wider impacts. (ALLEA - All European Academies, 2017, p. 4).

FNS-Cloud has already considered these principles in Deliverable 9.1, which we quote:

> D9.1: Ethical considerations within the FNS-Cloud project, will be governed by the principles as outlined national and EU codes of conduct, which are underpinned by the principles of Reliability, Honesty, Respect and Accountability. Each of these guiding principles will be considered across the full spectrum of work within FNS-Cloud, including the collection of novel data (study design, methodology) and analysis of existing and developed data sets (analysis, storage and sharing). All existing human data to be used within FNS-Cloud will have full ethical approval for collection, and studies which aim to collect novel human data will undergo full ethical approval prior to initiation.

4.3 Sustainability and future generations

In deliverable D8.2 we focused on the SDGs under a financial perspective. SDGs for the purposes of this deliverable are restricted to the values that underpin them. In the proposal to the Call H2020-SFS-2018-2020 (Sustainable Food Security), FNS-Cloud included subsection '2.3. Other environmental and socially important impacts' where the SDGs particularly relevant to FNS-Cloud SDGs were enumerated. These were 'SDG 1: Zero Poverty', 'SDG 2: Zero Hunger', 'SDG 3: Good health and well-being' and 'SDG 9: Industry and innovation' The specific targets attached to these SDGs are included as a reference in Appendix II.

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All ICT based projects have a daily environmental footprint produced by computers and the necessary energy they consume. Apart from this issue, hardware obsolescence is also a source of ecological problems. Therefore, ICT environmental sustainability must be considered. The studies related to these activities are an emerging field and could be subsumed under the concept of 'Sustainability in ICT: Making ICT goods and services more sustainable over their whole life cycle, mainly by reducing the energy and material flows they invoke' (Hilty and Aebischer, 2015, p. 21). Depending on the object and the outcome of ICT research, sustainability could not be an issue. For example, the alphabetical order is an algorithm extensively used by users of languages who use the alphabet derived from Greek characters, or Dublin Core is the metadata used by nearly all libraries in the world. Being the former an algorithm and the latter a metadata set, there is no register that they produce environmental impact (although propagating these algorithms does have an environmental impact). On the counterpart, the consumption of energy used by the computers that mine bitcoins may arrive at a tipping point where the obtention of a new bitcoin will not be worth as its value will be lower to the price of the consumed energy used in its obtention. Hence, depending on the activities developed by an ICT project, resource sustainability should be analysed and considered as it could imply the degradation of the environment.

The study of the impact of ICT projects is still a field to be further developed. Nevertheless, several regulations on sustainability are already developed. FNS-Cloud member of the consortium, Jozef Stefan Institute (JSI), is a public research institute, has a strict national regulation for 'green' purchasing (public procurement) of environmentally friendly equipment, like computers, air-conditioners, windows, etc., and follows the Energy Star standards[21]. At JSI they monitor the electricity consumption, including the electricity consumption for heating, and water consumption of water. Their hardware infrastructure is connected to the European Grid Infrastructure[22], which includes regulations required for the EGI sustainability.

These principles should be included in FNS-Cloud Charter and be respected by the organisation or organisations who will be responsible for the continuation of the project after its 48 months development to guarantee at maximum the usability of the data and metadata for future generations.

In addition, in deliverable D8.6 the risks associated with not taking these values into account should be analysed, as their non-observance may trigger responsibilities for the post project governing bodies.

21 Available at https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-products/energy-star_en
22 https://www.egi.eu

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5 FNS-Cloud Charter

We propose to be adopted by FNS-Cloud General Assembly the following Charter.

General Principles of FNS-Cloud Charter

The General Assembly of FNS-Cloud, composed each beneficiary's legal representatives,

Mission

Considering that FNS-Cloud mission is to:

Undertake existing data sourcing, collection/collation, mapping, and merging for demonstrators and use cases, to test and deliver a suite of data tool(s) supporting upload, analysis, and exploitation of FNS data within the FNS-Cloud environment and to showcase the potential for re-use by user communities;

Carry out data analysis and interpretations for microbiome data: (i) analyses within study, (ii) integration using network analysis, (iii) comparison with other similar repositories, and (iv) visualisation to aid interpretation.

Create and validate a user interface to access FNS data inventories and services, providing standards and guidelines for FNS data and APIs, developing and validating FNS-Cloud Services compatible with EOSC.

Develop and implement an Open Science and Open Innovation (governance) framework and sustainable business model addressing uneven access and reducing fragmentation of FNS resources.

Develop and implement targeted dissemination to increase awareness of better access to FNS data as well as support for exploitation, involving stakeholders and possible beneficiaries, improving confidence in exploitation through training.

Provide methods for capturing FNS knowledge.

Bring together ICT/data scientists both from academia and the private sector (especially SMEs) with FNS researchers.

Support a sustainable Food Systems Approach.

Bring together existing user communities, and rolling out knowledge, experience, and expertise to enhance awareness, increase confidence and skills, and promote exploitation.

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Develop a governance, business and financing model based on existing best practice and standards with Open Science and Open Innovation culture at the core of these frameworks.

Values and principles

Committed to the following principles:

(i) With respect to the core values of Open Science:

To adhere to UNESCO core values of Open Science (i) Collective Benefit, (ii) Equity and Fairness (iii) Quality and Integrity (iv) Diversity and (v) Inclusiveness.

(ii) With respect to the fundamental right to enjoy the benefits of scientific progress and its applications:

To adhere to the values expressed in articles 27 of the Universal Convention of Human Rights, article 15 of the International Covenant on Economic, Social and Cultural Rights, and article 13 of the Charter of Fundamental Rights of the European Union, all of them on the fundamental right to enjoy the benefits of science.

(iii) With respect to the guiding principles for Open Science:

To adhere to UNESCO guiding principles for Open Science (a)Transparency, scrutiny, critique and verifiability (b) Equal opportunities and access (c) Respect, responsibility and accountability (d) Collaboration, participation and inclusion (e) Flexibility and (f) Sustainability.

(iv) With respect to EOSC:

FNS-Cloud should make every effort to ensure its integration in EOSC, following the rules set in the EOSC agenda, the commitment to FAIR guidance principles and its rules for governance and sustainable development.

(v) With respect to privacy:

All data utilised and / or collected within the project FNS-Cloud will handled in accordance with specified European data regulations such as General Data Protection Regulation ('GDPR'), which regulates the processing by an individual, a company or an organisation of personal data relating to individuals in the EU and the Convention for the Protection of Individuals regarding Automatic Processing of Personal Data (CETS No. 108).

(vi) With respect to research integrity:

Ethical considerations within the FNS-Cloud project, will be governed by the principles as outlined national and EU codes of conduct, which are underpinned by the principles of Reliability, Honesty, Respect and Accountability. Each of these guiding principles will

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be considered across the full spectrum of work within FNS-Cloud, including the collection of novel data (study design, methodology) and analysis of existing and developed data sets (analysis, storage and sharing). All existing human data to be used within FNS-Cloud will have full ethical approval for collection, and studies which aim to collect novel human data will undergo full ethical approval prior to initiation.

(vii) With respect to SDGs:

Incorporate the Sustainable Development Goals into its core values, future business model and corporate governance system.

Vision statement

Considering the above mission, principles and values, FNS-Cloud is committed to:

Reduce the current fragmentation of Food Nutrition Security (FNS) European research infrastructure, federating FNS data essential for addressing diet, health, and consumer behaviour as well as on sustainable agriculture and the bioeconomy.

Enable interoperability, standardisation, access, integration of different existing and emerging FNS data.

Advance FNS scientific knowledge, reducing gaps that inhibit public health and agricultural policy, to benefit the food industry, reducing development and production costs, to facilitate informed consumer choice and ultimately, healthier European citizens.

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6 References

AGINFRA+ (2017). "Accelerating user-driven e-infrastructure innovation in Food Agriculture". *AGINFRA PLUS D4.4 - Open Science Publication Technologies.* Software deliverable. https://support.d4science.org/projects/aginfraplus_wiki/wiki/D44_-_Open_Science_Publication_Technologies

ALLEA – All European Academies (2017). *The European Code of Conduct for Research Integrity.* Berlin. *https://www.allea.org/wp-content/uploads/2017/05/ALLEA-European-Code-of-Conduct-for-Research-Integrity-2017.pdf*

Burgelman, J. C. (2021). "Politics and Open Science: How the European Open Science Cloud Became Reality (the Untold Story)". *Data Intelligence. Volume 3, Issue 1* Winter 2021. https://doi.org/10.1162/dint_a_00069

Chan, L.; Cuplinskas, D.; Eisen, M.; Friend, F.; Genova, Y.; Guédon, J.-C.; Hagemann, M.; Harnad, .; Johnson, R., Kupryte, R.; La Manna, M.; Rév, I., Segbert, M.; Souza, S. De; Suber, P.; Velterop, J. (2002). *Budapest Open Access Initiative*. http://www.budapestopenaccessinitiative.org/

Council of Europe (1950). *Convention for the Protection of Human Rights and Fundamental Freedoms.*

Drago, Federico, Ferguson, Nicholas, Tanlongo, Federica, Fuhrmann, Patrick, Götz, Andy, McBirnie, Abigail, Fazekas-Paragh, Judit. (2020, May 18). *Position papers on EOSC - Insights from Regional Projects & Infrastructures.* Zenodo. http://dx.doi.org/10.5281/zenodo.3831561

Eamon, W. (1986). "From the secrets of nature to public knowledge: The origins of the concept of openness in science". *Minerva*, *23*(3), 321-347. https://doi.org/10.1007/BF01096442

EOSC Executive Board. (2021). "Strategic Research and Innovation Agenda (SRIA) of the European Open Science Cloud (EOSC)" Version 1.0 15 February 2021. https://www.eosc.eu/sites/default/files/EOSC-SRIA-V1.0_15Feb2021.pdf

European Commission. (2007). *Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee on scientific information in the digital age: access, dissemination and preservation {SEC(2007)181}*. https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52007DC0056

European Commission. (2012). *Commission Recommendation of 17.7.2012 on access to and preservation of scientific information. C(2012) 4890 final.* https://ec.europa.eu/research/science-society/document_library/pdf_06/recommendation-access-and-preservation-scientific-information_en.pdf

European Commission. (2015). *Validation of the results of the public consultation on Science 2.0: Science in Transition*. https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=9407

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 863059.

European Commission. (2016). *Communication from the commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Rregions. European cloud initiative -building a competitive data and knowledge economy in Europe. COM(2016) 178 final.* http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=15266

European Commission. (2017). *Information Note towards a Horizon 2020 platform for open access*. https://ec.europa.eu/research/openscience/pdf/information_note_platform_public.pdf

European Commission. (2018). Commission Staff Working Document. Implementation Roadmap for the European Open Science Cloud SWD(2018) 83 final. https://ec.europa.eu/research/openscience/pdf/swd_2018_83_f1_staff_working_paper_en.pdf

European Union (2000). *Charter of Fundamental Rights of the European Union*. (2000/C 364/01). https://www.europarl.europa.eu/charter/pdf/text_en.pdf

European Union (2018). *Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)*. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679

Gotz, A,; Petzold, A.; Asmi, A.; Blomberg, N.; Lamanna, G. & Dekker, R. (2020, February 19). *ESFRI cluster projects - Position papers on expectations and planned contributions to the EOSC*. Zenodo. http://doi.org/10.5281/zenodo.3675081

Hess, C. & Ostrom, E. (2003). "Ideas, Artifacts, and Facilities: Information as a Common-Pool Resource", *66 Law and Contemporary Problems* 111-146 (Winter 2003). https://scholarship.law.duke.edu/lcp/vol66/iss1/5

Hilty, Lorenz M. and Aebischer, B. (2015). 'ICT Innovations for Sustainability: An Emerging Research Field', in Hilty, Lorenz M. and Aebischer, B. (editors) *ICT Innovations for Sustainability, Advances in Intelligent Systems and Computing,* Volume 310. Switzerland: Springer.

Lafuente, A. & Alonso. A. (2011). *Ciencia expandida, naturaleza común y saber profano.* Bernal (Buenos Aires, Argentina): Universidad Nacional de Quilmes Editorial.

Méndez, E.; Lawrence, R.; MacCallum, C. J.; Moar, E. (2020). *Progress on Open Science: Towards a Shared Research Knowledge System. Final Report of the Open Science Policy Platform*. https://ec.europa.eu/research/openscience/pdf/ec_rtd_ospp-final-report.pdf

Merton, Robert K. (1973). *The Sociology of Science. Theoretical and Empirical Investigations.* Chicago: The University of Chicago Press.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 863059.

Netherlands (2016). *Amsterdam Call for Action on Open Science*. https://www.government.nl/binaries/government/documents/reports/2016/04/04/amsterdam-call-for-action-on-open-science/amsterdam-call-for-action-on-open-science.pdf

Pontika, N.; Knoth, P.; Cancellieri, M.; Pearce, S. (2015). "Fostering Open Science to Research using a Taxonomy and an eLearning Portal". *i-KNOW '15: Proceedings of the 15th International Conference on Knowledge Technologies and Data-driven Business.* October 2015 Article No.: 11 Pages 1–8 https://doi.org/10.1145/2809563.2809571

Unger, R. M. (2019). *The Knowledge Economy*. Verso. http://www.robertounger.com/wp-content/uploads/2019/03/FINAL-TEXT-PROOFS_The-Knowledge-Economy-2.pdf

UNESCO. (2020). *First draft of the UNESCO Recommendation on Open Science.* https://unesdoc.unesco.org/ark:/48223/pf0000374837.locale=en

United Nations. (1948). *Universal Declaration of Human Rights*. https://www.un.org/en/about-us/universal-declaration-of-human-rights

Véliz, C. (2020). *Privacy is Power. Why and how you should take back control of your data*. London: Penguin Books.

Zuboff, S. (2019). *The Age of Surveillance Capitalism. The Fight for a Human Future at the New Frontier of Power.* London: Profile Books.

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7 Appendix

7.1 Appendix I. List of EOSC Projects

1. AENEAS Advanced European Network of E-infrastructures for Astronomy with the SKA 01/2017 12/2019 www.aeneas2020.eu @aeneas2020
2. AGINFRA+ Accelerating user-driven e-infrastructure innovation in Food Agriculture 01/2017 12/2019 plus.aginfra.eu @aginfra
3. ARCHIVER Archiving and Preservation for Research Environments 01/2019 12/2021 www.archiver-project.eu @ArchiverProject
4. BE OPEN European forum and oBsErvatory for OPEN science in transport 01/2019 06/2021 beopen-project.eu @OpenScTransport
5. Blue-Cloud Piloting innovative services for Marine Research & the Blue Economy 10/2019 09/2022 www.blue-cloud.org @BlueCloudEU
6. CatRIS Catalogue of Research Infrastructure Services 01/2019 06/2021 project.catris.eu @projectcatris
7. CINECA Common Infrastructure for National Cohorts in Europe, Canada, and Africa 01/2019 12/2022 www.cineca-project.eu @CinecaProject
8. COS4CLOUD Co-designed Citizen Observatories Services for the EOS-Cloud 11/2019 02/2023 www.cos4cloud-eosc.eu @Cos4Cloud
9. CS3MESH4EOSC Interactive and agile/responsive sharing mesh of storage, data and applications for EOSC 01/2020 12/2022
10. DARE Delivering Agile Research Excellence on European e-Infrastructures 01/2018 12/2020 project-dare.eu @EUprojectDARE
11. DEEP - Hybrid-DataCloud Designing and Enabling E-infrastructures for intensive Processing in a Hybrid DataCloud 11/2017 04/2020 deep-hybrid-datacloud.eu @DEEPeu
12. DigitalHealthEurope Support to a Digital Health and Care Innovation initiative in the context of Digital Single Market strategy 01/2019 12/2020 digitalhealtheurope.eu @DHE2020
13. e-IRGSP6 e-Infrastructure Reflection Group Support Programme 6 01/2019 06/2021 e-irgsp6.e-irg.eu @eirgeu
14. eInfraCentral European E-Infrastructure Services Gateway 01/2017 06/2019 einfracentral.eu @eInfraCentral

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15. ENVRI-FAIR ENVironmental Research Infrastructures building Fair services Accessible for society, Innovation and Research 01/2019 12/2022 envri.eu @ENVRIcomm
16. EOSC Enhance Enhancing the EOSC portal and connecting thematic clouds 12/2019 11/2021 www.eosc-portal.eu @EoscPortal
17. EOSC-hub Integrating and managing services for the European Open Science Cloud 01/2018 12/2020 eosc-hub.eu @EOSCeu
18. EOSC-Life Providing an open collaborative space for digital biology in Europe 03/2019 02/2023 www.eosc-life.eu @EoscLife
19. EOSC-Nordic EOSC-Nordic 09/2019 08/2022 www.eosc-nordic.eu @EOSCNordic
20. EOSC-Pillar Coordination and Harmonisation of National Inititiatives, Infrastructures and Data services in Central and Western Europe 06/2019 06/2022 www.eosc-pillar.eu @EoscPillar
21. EOSC-Synergy European Open Science Cloud - Expanding Capacities by building Capabilities 09/2019 02/2022 www.eosc-synergy.eu @EOSCsynergy
22. EOSCpilot The European Open Science Cloud for Research Pilot Project 01/2017 05/2019 eoscpilot.eu @eoscpilot
23. EOSCsecretariat.eu EOSCsecretariat.eu - Setup and amagement of the EOSC Secretariat supporting the EOSC Governance 01/2019 06/2021 www.eoscsecretariat.eu @EoscSecretariat
24. ESCAPE European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures 02/2019 07/2022 www.projectescape.eu @ESCAPEEU
25. ExPaNDS EOSC Photon and Neutron Data Services 09/2019 08/2022 expands.eu @ExPaNDsEU
26. FAIR4Fusion 09/2019 08/2021 www.fair4fusion.eu @fair4fusion
27. FAIR4Health Improving Health Research in EU through FAIR Data 12/2018 11/2021 www.fair4health.eu @Fair4Health
28. FAIRplus FAIRplus 01/2019 06/2022 fairplus-project.eu @FAIRpluseu
29. FAIRsFAIR Fostering Fair Data Practices in Europe 03/2019 02/2022 fairsfair.eu @FAIRsFAIR_EU
30. FNS-Cloud Food Nutrition Security Cloud 10/2019 09/2023 www.fns-cloud.eu @FNSCloudEU
31. FREYA Connected Open Identifiers for Discovery, Access and Use of Research Resources 12/2017 11/2020 www.project-freya.eu @freyaeu

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32. GN4-3 Horizon 2020: H2020-SGA-INFRA-GEANT-2018 Topic [b] Increase of Long-Term Backbone Capacity 01/2019 12/2022 www.geant.org @GEANTnews
33. HNSciCloud Helix Nebula Science Cloud 01/2016 12/2018 www.hnscicloud.eu @HelixNebulaSC
34. ICEDIG Innovation and consolidation for large scale digitisation of natural heritage 01/2018 03/2020 www.icedig.eu @ICEDIGeu
35. INODE Intelligent Open Data Exploration 11/2019 10/2022 www.inode-project.eu
36. NEANIAS Novel EOSC services for Emerging Atmosphere, Underwater and Space Challenges 11/2019 10/2022 www.neanias.eu @Neaniaseu
37. NI4OS-Europe National Initiatives for Open Science in Europe 09/2019 08/2022 ni4os-europe.eu @NI4OSeu
38. OCRE Access to Commercial Services Through the EOSC-hub 01/2019 12/2021 www.ocre-project.eu @OCREproject
39. OpenAIRE-Advance OpenAIRE Advancing Open Scholarship 01/2018 12/2020 www.openaire.eu @OpenAIREeu
40. OpenRIskNet Open e-Infrastructure to Support Data Sharing, Knowledge Integration and in silico Analysis and Modelling in Risk Assessment 12/2016 11/2019 openrisknet.org @openrisknet
41. PaNOSC Photon and Neutron Open Science Cloud 12/2018 11/2022 panosc.eu @Panosceu
42. PRIMAGE PRedictive In-silico Multiscale Analytics to support cancer personalized diaGnosis and prognosis, Empowered by imaging biomarkers 12/2018 11/2022 www.primageproject.eu @primageproject
43. PROCESS PROviding Computing solutions for ExaScale ChallengeS 11/2017 10/2020 www.process-project.eu @PROCESSH2020
44. RDA Europe 4.0 Research Data Alliance 03/2018 05/2020 www.rd-alliance.org @resdatall
45. SSHOC Social Sciences & Humanities Open Cloud 01/2019 04/2022 sshopencloud.eu @SSHOpenCloud
46. TRIPLE Transforming Research through Innovative Practices for Linked interdisciplinary Exploration 10/2019 10/2023 https://www.gotriple.eu/ cordis.europa.eu @TripleEU
47. VirtualBrainCloud Personalized Recommendations for Neurodegenerative Disease 12/2018 11/2022 virtualbraincloud-2020.eu @TVBcloud
48. XDC eXtreme DataCloud 11/2017 01/2020 www.extreme-datacloud.eu @XtremeDataCloud

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7.2 Appendix II. SDG's and their specific targets applicable to FNS-Cloud[23]

Goal 1. End poverty in all its forms everywhere

1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day

1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions

1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable

1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance

1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters

1.a Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions

1.b Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round

2.2 By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons

2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including

23 See United Nations A/RES/70/1: https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

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through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment

2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality

2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed

2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries

2.b Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round

2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility

Goal 3. Ensure healthy lives and promote well-being for all at all ages

3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births

3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births

3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases

3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being

3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol

3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents

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3.7 By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes

3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all

3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination

3.a Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate

3.b Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all

3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States

3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all

9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries

9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets

9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound

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technologies and industrial processes, with all countries taking action in accordance with their respective capabilities

9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending

9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States

9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, *inter alia*, industrial diversification and value addition to commodities

9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020

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