**EUROPEAN OPEN
SCIENCE CLOUD**

Summary report from the EOSC
regional projects based on the
second round of the consultation

Second Working
Proposal for Living
Indicators to Monitor
MS Progresses
Towards EOSC
Readiness

Second Working Proposal for Living Indicators to Monitor MS Progresses Towards EOSC Readiness

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Acknowledgements

Disclaimer

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1 INTRODUCTION

The Landscaping Task Force (TF), consisting of representatives of EOSC Regional Projects (EOSC-Pillar[1], EOSC-Nordic[2], NI4OS-Europe[3], EOSC Synergy[4], ExPaNDS[5]) and FAIRsFAIR[6] in collaboration with EOSCsecretariat.eu[7], has proposed an initial list of potential EOSC readiness indicators in Member States[8] and Associated Countries[9]. Originally, the request for the action of collecting these indicators was initiated by the Landscape Working Group[10] of the EOSC Executive Board[11]. In order to respond to this request, the Landscaping Task Force has started identifying indicators proposed for assessing EOSC readiness and engaging stakeholders into the process of validation. The Landscaping Task Force is one of 6 thematic task forces set up to facilitate collaboration among the INFRAEOSC-05 projects.

1.1 How to Read This Report

This document presents the results of the public consultation for the proposed readiness indicators that were collected during the two rounds of consultation as a questionnaire (see Appendix 1). It is a follow up of the earlier report, "Working Proposal for Living Indicators to Monitor Member States Progresses towards EOSC Readiness"[12], which presents the results of the first round of consultations that took place as an open survey during the session of "National Policy Developments Supporting EOSC Implementation"[13] during the EOSChub Week[14] on 20 May 2020.

This report also discusses the usefulness of an initial set of indicators proposed as well as discussing the responsibility for monitoring progress against indicators. This document

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[1] (n.d.). EOSC-Pillar. Retrieved October 22, 2020, from https://www.eosc-pillar.eu/

[2] (n.d.). EOSC-Nordic. Retrieved October 22, 2020, from https://www.eosc-nordic.eu/

[3] (n.d.). NI4OS- Europe. Retrieved October 22, 2020, from https://ni4os.eu/

[4] (n.d.). EOSC synergy. Retrieved October 22, 2020, from https://www.eosc-synergy.eu/

[5] (n.d.). expands.eu. Retrieved October 22, 2020, from https://expands.eu/

[6] (n.d.). FAIRsFAIR. Retrieved October 22, 2020, from https://www.fairsfair.eu/

[7] (n.d.). EOSCSecretariat. Retrieved October 22, 2020, from https://www.eoscsecretariat.eu/

[8] (n.d.). EU Member States | EOSC Portal. Retrieved October 22, 2020, from https://www.eosc-portal.eu/policy/eu-member-states

[9] (n.d.). EOSC Governance Board | EOSC Portal. Retrieved October 22, 2020, from https://www.eosc-portal.eu/governance/eosc-board

[10] (n.d.). Landscape Working Group | EOSCSecretariat. Retrieved October 22, 2020, from https://www.eoscsecretariat.eu/working-groups/landscape-working-group

[11] (n.d.). EOSC Executive Board | EOSCSecretariat. Retrieved October 22, 2020, from https://www.eoscsecretariat.eu/eosc-governance/eosc-executive-board

[12] (n.d.). Working Proposal for Living Indicators to Monitor MS .... Retrieved October 22, 2020, from https://www.eoscsecretariat.eu/sites/default/files/working_proposal_for_living_indicators_to_monitor_ms_progresses_towards_eosc_readiness.pdf

[13] (2020, May 20). National Policy Developments Supporting EOSC ... - EOSC Hub. Retrieved October 22, 2020, from https://www.eosc-hub.eu/eosc-hub-week-2020/agenda/national-policy-developments-supporting-eosc-implementation

[14] (n.d.). Agenda | EOSC Hub. Retrieved October 22, 2020, from https://www.eosc-hub.eu/eosc-hub-week-2020/agenda

suggests a response to the question: **"How can we monitor the status and progresses of MS and AC towards the EOSC implementation and identify opportunities and areas of improvement?"** Many practical issues must still be progressed, such as the frequency of assessing progress against agreed indicators, a shared evaluation process with clearly defined roles and responsibilities and agreed forms of evidence to support evaluation decisions.

The preliminary results of the consultation were discussed at the Final Landscape Validation Workshop[15][16] and they will be included in the Landscaper WG report published in November 2020. Furthermore, the results can provide valuable input to the Strategic Research and Innovation Agenda[17] (SRIA) and to the EOSC Association[18] activities. The SRIA Draft v0.8 document highlights the need for monitoring initiatives.[19] Furthermore, a preliminary list of KPIs is included but as the KPIs have not yet been fully elaborated, the work on the readiness indicators by the Landscaping Task Force may have a possible impact on the refinement of the draft KPIs as well. During the EOSC Symposium session related to GAIA-X called **Widening to the public and private sectors[20]** on 21 October 2020 there were discussions on KPIs and indicators with collaborative partners which should be added to a combined roadmap. Therefore, the work done should be taken into account related to this document as well.

The topic and the statements of this document remain dynamic depending on the development of EOSC in order to implement the indicators in the most beneficial way for EOSC.

The Landscaping Task Force defined a working proposal with a set of indicators in five macro key areas: **Architecture, Organisation & Governance, Policies, Infrastructure, Training and Skills.** The aim of the current report is to present the indicators and their purpose and could provide a draft framework of KPIs to assess EOSC readiness. The framework should be flexible enough to reflect different forms and levels of performance that may be recommended or required by emerging EOSC[21] governance structures and the EOSC Association. Additionally, the scope remains to discuss by whom the indicators would be implemented as well.

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[15] (n.d.). EOSC Landscape Final Validation Workshop | EOSCSecretariat. Retrieved November 9, 2020, from https://www.eoscsecretariat.eu/events/eosc-landscape-final-validation-workshop

[16] (2020, October 13). EOSC Landscape Working Group Final Workshop .... Retrieved November 9, 2020, from https://www.eoscsecretariat.eu/news-opinion/eosc-landscape-working-group-final-workshop

[17] (2020, July 20). July 2020 - EOSC Secretariat. Retrieved October 22, 2020, from https://www.eoscsecretariat.eu/sites/default/files/open_consultation_booklet_sria-eosc_20-july-2020.pdf

[18] (n.d.). Application for joining the EOSC Association | EOSCSecretariat. Retrieved October 20, 2020, from https://www.eoscsecretariat.eu/application-joining-eosc-association

[19] (2020, July 20). July 2020 - EOSC Secretariat. Retrieved October 20, 2020, from https://www.eoscsecretariat.eu/sites/default/files/open_consultation_booklet_sria-eosc_20-july-2020.pdf

[20] (n.d.). Andreas Weiss: Widening to the public and private sectors see the programme | EOSCSecretariat. Retrieved November 18, 2020, from https://www.eoscsecretariat.eu/eosc-symposium-2020-programme

[21] (n.d.). European Open Science Cloud (EOSC) - European Commission. Retrieved October 22, 2020, from https://ec.europa.eu/research/openscience/index.cfm?pg=open-science-cloud

1.2 Methodology

The findings of this report build on the responses on the consultation responses of different stakeholders collected by the Landscaping Task Force.

1.2.1 Consultation

The second round of consultation[22] took place from 24 July to 14 September 2020 as an open survey via a dedicated web form provided by EOSCsecretariat.eu. The stakeholders were contacted in a targeted way to respond on the survey. Some comments also arrived via email. The consultation template (see the Annex 1) included questions concerning monitoring, responsibilities, regularity and publicity with possibility to provide further comments in some of them. The questions with options to rank the specific proposed indicators were divided in the five sections: Architecture, Organization and Governance, Group Policies, Infrastructures and Training and Skills. Each section of ranking the specific indicators included a possibility to provide additional comments if any.

In total, approximately 200 people were involved in the two rounds of consultation. The consultation allowed people to rate the importance of the draft indicators and to provide free comments. The second round of consultation[23] gained 42 responses from various European countries. The consultation was targeted to the EOSC Governance Board, EOSC Executive Board Working Group delegates[24] as well as to the leaders in RIs and National Open Science Cloud Initiatives (NOSCI). However, the majority of the responses came from the EOSC Governance Board and EOSC Working Groups. Nearly 1/3 of the Governance Board delegates[25] provided feedback. Respondents were located in 19 different MS and AC countries, mostly from Southern and Eastern Europe.

The Task Force also received some comments concerning the methodology of the consultation which emphasised that more options would have been required for questions as well as more possibilities for open commenting. Therefore, the indicators presented in this report can be regarded as suggestions for possible indicators to measure the Member States EOSC readiness. As the indicators would measure the EOSC readiness of Member States, it is of utmost importance to engage all stakeholders into the future work of the indicators. The Task Force also received some additional textual comments in addition to the input that was collected through the questionnaire. **We expect the discussion around indicators to continue among different facets throughout the year 2020-2021.** Given the dynamic

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[22] (n.d.). Consultation on EOSC Readiness indicators for States .... Retrieved November 18, 2020, from https://www.eoscsecretariat.eu/questions-validation-readiness-indicators

[23] (n.d.). Consultation on EOSC Readiness indicators for States .... Retrieved October 20, 2020, from https://www.eoscsecretariat.eu/consultation-eosc-readiness-indicators-states

[24] (n.d.). EOSC Working Groups | EOSCSecretariat. Retrieved October 22, 2020, from https://www.eoscsecretariat.eu/eosc-working-groups

[25] (n.d.). EOSC Governance Board | EOSC Portal. Retrieved October 22, 2020, from https://www.eosc-portal.eu/governance/eosc-board

nature of the landscape, this report will be maintained as a living document and it will be possible to provide further comments once the report has been published on Zenodo community of EOSCsecretariat.eu[26].

The work on EOSC readiness indicators will be moving from a static landscape-view to a set of living indicators against which progress will be monitored. **The transition requires community agreement on which indicators should be monitored, at which points in time, and by whom.** Below, we share the results of the consultations with a discussion on what is needed to accomplish this objective.[27]

The results of consultation have also been preliminarily presented and further discussed during the Final Validation Workshop[28] organised by the EOSC EB Landscape Working Group in collaboration with EOSCsecretariat.eu. The event was held as an invitation-only event 28-29 September 2020 both at Thon Hotel EU, Brussels and remotely.[29]

1.2.2 Structure of the Report

The report is structured as following:

Chapter 1 - Introduction presents an overview of the background of the report, its content and aims.

Chapter 2 - Requirements for EOSC Implementation provides insights and an overview of the responses concerning monitoring, publicity of indicators, certification and exhaustiveness. It also presents the challenges of the EOSC Readiness Indicators that appeared in the survey responses.

Chapter 3 - Results of Evaluation on The Proposed Indicators shows the results of the respondents voting on the specific set of indicators.

Chapter 4 - Highlights of the Survey Results summarizes the highlights of the survey results that appear in this report.

Chapter 5 - Conclusions includes an overview of possible next steps appeared on the survey results.

Chapter 6 - List of Abbreviations used in this report.

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[26] EOSC Secretariat site on Zenodo Community:
https://zenodo.org/communities/eoscsecretariat/?page=1&size=20
[27] (n.d.). Consultation on EOSC Readiness indicators for States .... Retrieved October 20, 2020, from https://www.eoscsecretariat.eu/consultation-eosc-readiness-indicators-states
[28] (n.d.). EOSC Landscape Final Validation Workshop | EOSCSecretariat. Retrieved October 22, 2020, from https://www.eoscsecretariat.eu/events/eosc-landscape-final-validation-workshop
[29] (n.d.). EOSC Landscape Final Validation Workshop | EOSCSecretariat. Retrieved October 20, 2020, from https://www.eoscsecretariat.eu/events/eosc-landscape-final-validation-workshop

Annex 1 includes the survey questions used to collect the information from the stakeholders.

Annex 2 provides the link to the anonymised responses.

Annex 3 presents references for Indicators outside of this report.

1.3 Influence to EOSC

Monitoring preparedness as well as monitoring KPIs are closely interconnected but separate concepts. Indicators could be seen as looking at different stages and levels of the EOSC development. Preparedness is a measurement of how a country functions at an early stage, ideally ending when a country is ready. KPI's are measurements of more granular functions in a later stage, when certain, if not all of those functions are in operation. It would be important to separate indicators that assess a given stakeholder's readiness to participate in EOSC from those that will assess performance related aspects of EOSC participation.

The need for KPIs is emphasized in the Strategic Research and Innovation Agenda (SRIA)[30]. It is important to mention the process and responsibilities in addition to the indicators. The Report from the Landscape Working Group *Landscape of EOSC-related infrastructures and initiatives[31]* was published in September 2020. However, the current situation is that the information provided in the country sheets becomes outdated very quickly as the EOSC landscape is changing and developing rapidly. Therefore, there is the constant request for updated information to support the ongoing assessments concerning the readiness and preparedness of states and joining EOSC. In order to enable monitoring of progress and performance of the national infrastructures and initiatives as well as the development of national policies, an agreed set of common KPIs and associated sources of evidence are needed. As the KPIs will have an impact on the development processes of national environments, they should be approved by the major national stakeholders and representatives of the Member States in question. Wherever possible, data collection to provide evidence on progress should be automated drawing on agreed sources of open data (e.g., re3data, FAIRsharing). However, automated data collection, which provides quantitative information, must be used to support rather than replace the expertise of the evaluation or monitoring panel who must also consider qualitative information. Therefore, monitoring should not be reduced only to administrative procedures but efforts should be made to reduce the burden on those carrying out assessments so that they can focus on collecting qualitative evidence.[32]

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[30] (2020, October 18). SRIA v0.8 - EOSC Secretariat. Retrieved October 30, 2020, from https://www.eoscsecretariat.eu/sites/default/files/eosc-sria-v08.pdf

[31] (2020, September 14). Landscape of EOSC-related infrastructures and initiatives .... Retrieved October 30, 2020, from https://op.europa.eu/en/publication-detail/-/publication/cbb40bf3-f6fb-11ea-991b-01aa75ed71a1/language-en/format-PDF/source-156485650

[32] (2020, October 18). SRIA - EOSC Secretariat. Retrieved October 30, 2020, from https://www.eoscsecretariat.eu/sites/default/files/eosc-sria-v08.pdf

According to the Open Consultation results of the SRIA, the priorities for continuous monitoring are the following:

- Standardised national Open Science and FAIR data strategies as well as the description of policies.
- National policies on Open Access publishing, data and services and open learning.
- Financial incentives and schemes for support of Open Science and FAIR data.
- The existence of central or national contact point(s) for Open Science.
- National, regional or sector-level evaluation schemes of universities and research organisations as well as the status of Open Science principles and open access schemes.[33]

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[33] (2020, October 18). SRIA - EOSC Secretariat. Retrieved October 30, 2020, from https://www.eoscsecretariat.eu/sites/default/files/eosc-sria-v08.pdf

2 REQUIREMENTS FOR EOSC IMPLEMENTATION

2.1 Monitoring

The majority of the respondents in the two rounds of consultation consider the indicators useful. The major concerns touch upon the effort required to execute monitoring as well as the regularity. Mainly, **automation and machine actionability were voted as solutions to solve the issues**.

2.1.1 Regularity

During the second round of consultations, most of the respondents agreed that **monitoring a set of common indicators on a regular basis** is important**. As described in Figure 1, **it was highlighted that monitoring should be done once a year and would help in assessing progress of EOSC within the MS/AC. It was highlighted that monitoring at the country level would support assessing the progresses of EOSC within the Member States.** The strong majority (90%) of the respondents agreed on the statement where 10% of respondents had described they agree partly or they do not agree. However, several commenters offered that **monitoring based on national reports should not increase the administrative burden of the Member States**.
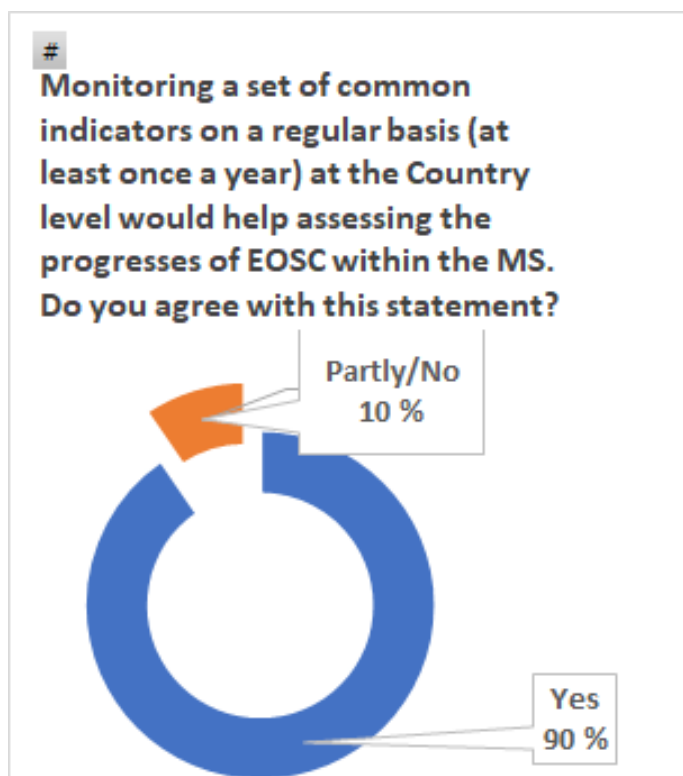
Figure 1: Monitoring regularly at country level to assess progress of EOSC within MS.

It was also mentioned that usefulness depends on how much effort would be needed, pointing out that **automation of data collection of indicators would be vital**. One respondent suggested institutional levels would be the best channel for monitoring.

2.1.2 Levels of Responsibility

As described in Figure 2, the opinions are rather divided on who should be responsible for monitoring progress against the indicators. **55% of respondents disagree with the proposal that National Open Science Initiatives (NOSCIs) be responsible for monitoring the indicators.**

Reasons for not agreeing include the risk of monitoring becoming a lobbying instrument, and the importance of veracity and equanimity in the measurements, all reasons that would make **a neutral actor preferable to perform the monitoring.** During the first Landscape Validation Workshop there were points raised about whether any monitoring body might be perceived as neutral.

Monitoring should be a joint action where NOSCIs would provide the data under coordination of a neutral actor, who would be responsible for the analysis and the evaluation of preparedness. A certain degree of lobbying at this level would be inevitable and perhaps

healthy, if it can represent a stimulus for countries to accelerate the process and get ready faster. NOSCI's acting as coordinators pulling together contributions from relevant stakeholders in the country (such as RPOs, RIs, repositories) would not be responsible for collecting the data but help to coordinate it. It was pointed out by some respondents that in such cases benchmarking could also be a solution. It was suggested by some respondents that monitoring by national authorities or organisations could be accredited on governmental level and where possible, assisted by Open Science Initiatives contact points.

It was mentioned in a comment from a respondent that NOSCI's in some countries may not be in position to carry out or enforce reporting and validation of data though monitoring at national level and was suggested to be done by the National Open Science Initiatives after detailed consultation of the users of EOSC instead. Therefore, it could be considered that there are two key issues to take in consideration: one is the NOSCI's capacity to carry out the monitoring based on the resources available in the country (such as staff time) and the other is whether they are the right group to try to enforce the reporting of the required data to be analysed during assessments.

According to the survey results it was highlighted by some respondents to collect information at first on the national level and afterwards to consolidate the information at EU or international level. Another suggestion was mentioned about **the EOSC Association to steer the monitoring.** Among the responses it appeared that the range of information being suggested varies, and therefore it may require a significant effort to execute monitoring although **monitoring should be maintained as a shared effort.**
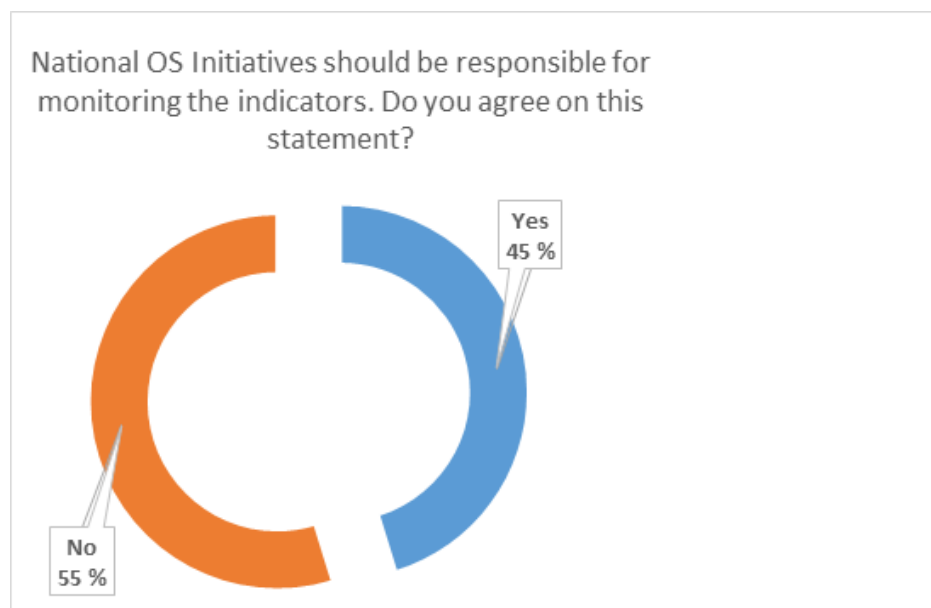

Figure 2: Opinion about National OS Initiatives to be responsible for monitoring.

Among the responses it was mentioned that more than one initiative may end up resulting in fragmented and/or overlapping monitoring. It was explained the main actor in the field is not just related to Open Science as overall the **efficiency of the research investment field should be monitored** in return on investments in EOSC. As a reflection of this statement it would be possible that the efficiency in this concept might indicate that some respondents were focusing more on the KPI (implementation/operation) phase than on the preparedness aspects. **A centralized entity for jointly monitoring indicators would be beneficial to manage indicators also on global level**.

It was pointed out by a respondent that the progress towards commonly agreed goals should be addressed firstly, and secondly the national managerial practice should be agreed. On the third priority the formative role of the monitoring should be defined.

As an option for joint monitoring it was also suggested the mandated organizations to manage monitoring supported by other organisations involved in EOSC from the particular country. Another recommendation was for **guidelines to be available and central harvesting to be done at EU level, while the data collection should be executed at national level.** It was recommended the **common indicators used should be discussed and evaluated regularly**, preferably once a year, but operationalised at a national level.

According to the consultation results, more than half **(60%) of respondents agree that monitoring should be managed both at national and EU levels**. 21% of respondents have the opinion that it should be monitored on EU or international level as shown in Figure 3. Also, several respondents highlighted that the measurements **should be followed by a list of various measures and actions that could be suggested for self-improvement by a committee of experts.**

It was recommended by some respondents that each disciplinary should be assessed by the EOSC community itself rather than on MS/AC level, except if there was a clear mandate for each MS/AC to designate one EOSC provider in each country and delegate it as a member from the country. However, it was highlighted that some indicators could be collected by countries, while others not.
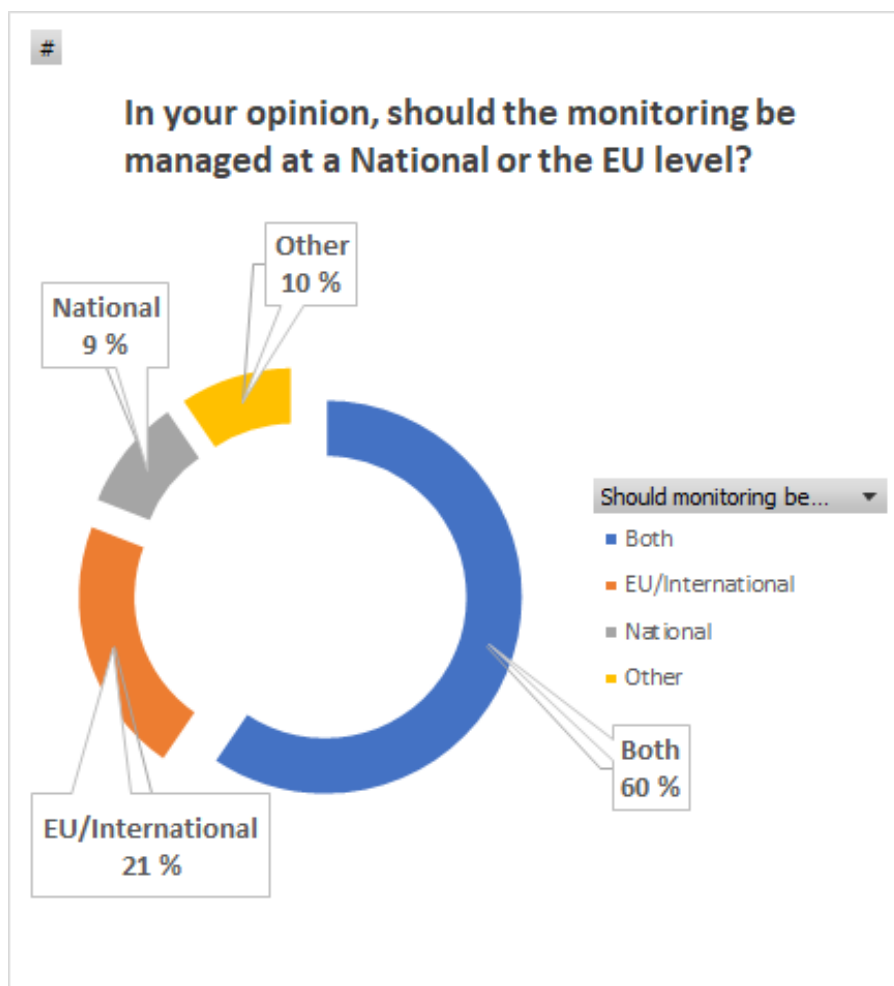
Figure 3: Opinion of the management of monitoring on national or EU level.

2.2 Publicity of Indicators

In the first round of consultation, 89% of respondents stated the measurements should be public, with possible exceptions for sensitive information to be restricted[34]. However, as shown in the table below, in the second round the strong majority (**95%) of respondents also agreed on the statement that the measurements should be public with restrictions of sensitive information.** The 5% of respondents who had a different view explained their disagreement by offering that only a minor part of the collected information would be of public interest, and that information could have sensitive aspects (e.g. budgetary info). It was stated by some recipients that **only aggregated data should be public, and a clear difference between internal indicators and public indicators should be defined.**

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[34] (n.d.). Working Proposal for Living Indicators to Monitor MS .... Retrieved October 20, 2020, from https://www.eoscsecretariat.eu/sites/default/files/working_proposal_for_living_indicators_to_monitor_ms_progresses_towards_eosc_readiness.pdf
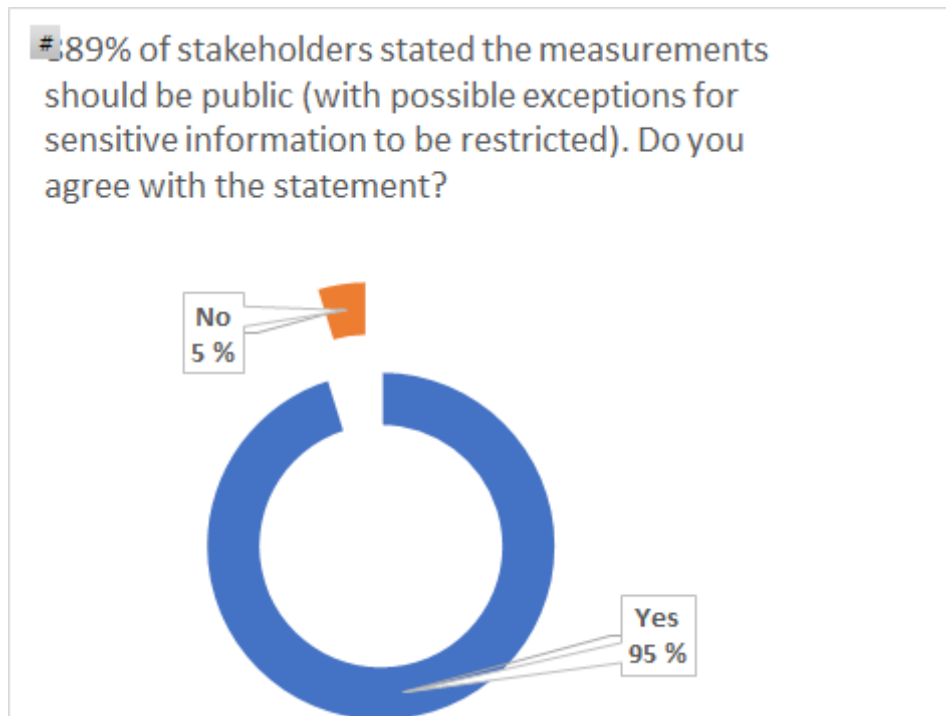
Figure 4: Publicity excluding the sensitive information.

In the consultation, the respondents were also asked to define which information they would exclude from public domain, if any. The responses highlighted that **the disclosed data should be compliant with the GDPR and other relevant legislation.**

It was suggested by a respondent that the general principle could be that data as a rule would be open, and countries could manage the restrictions themselves, if required. Another interesting highlight was pinpointed on this topic: the FAIR spirit should be followed up and the data source to be able to leave out or to keep the data (anonymised when necessary). However, it was suggested that some of the information, albeit open, **may lack the necessary context** to be understood. In this case, a possible course of action could be to provide information on the specific measurement alongside the measurement itself or, if this is not possible, just keep that particular information restricted.

However, the general agreement seems to be that in the spirit of Open Science, **the data should stay as open as possible and as closed as necessary**.

2.3 Certification

Figure 5: Opinions about using self-assessment or independent certification at EU level.

As shown in Figure 5, the respondents have different opinions about the indicators being self-assessed or if independent certification should be in place. In the first round of consultation 50% of respondents considered self-assessment would be enough, where 38% of responses indicated there should be Certification on EOSC level. In the 2nd round of consultation, **51% of the respondents consider self-assessment more useful than independent certification.**
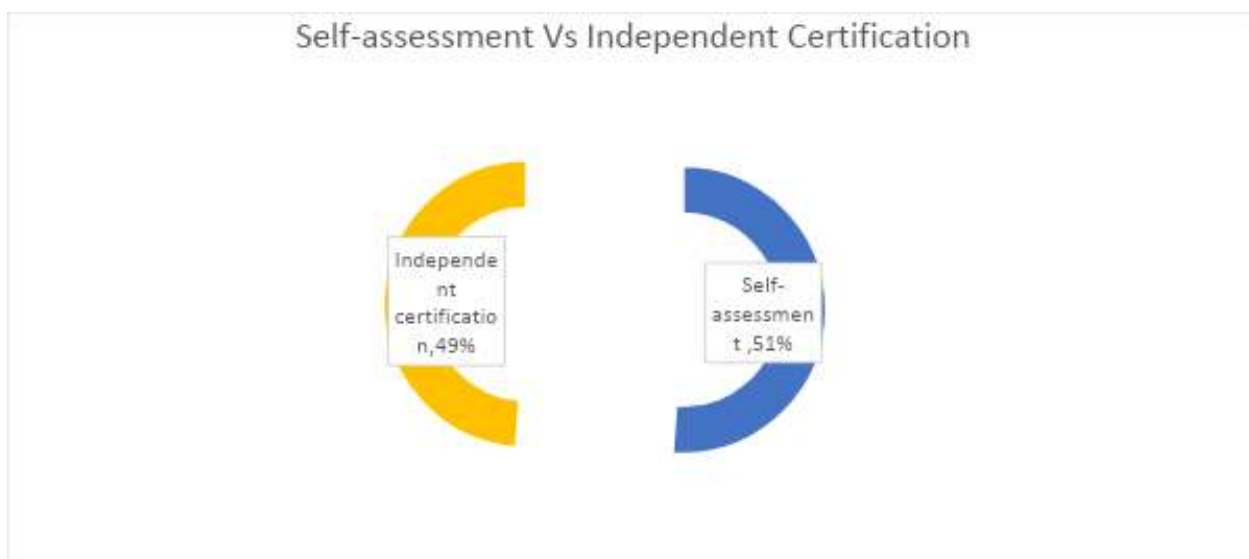
Various additional comments were offered by respondents regarding this question, many of which suggest that a hybrid approach could be sought on this topic. On one hand, it was pointed out that each organisation or country should be able to self-assess the progress on the organisational or national level by understanding their internal conditions having impacts on development of the EOSC. It was also pinpointed that the **FAIR principles should be adopted in relation to the assessment too, in order to ensure that KPIs remain objective and the measurement process transparent and reproducible.** On the other hand, independent certification would contribute to reduce the asymmetries that can occur between different Member States concerning the EOSC implementation. Independent certification would enable more comparable results between assessments, and ensure **a consistent application of methodology**, however too much overhead for this activity would draw attention and resources into the wrong direction. A recurrent concern is that **the certification at EOSC level would add more workload** for EOSC representatives. Certification might be seen as a bureaucratic hindrance instead of a means to ensure the reliability of the information.

It was mentioned by a respondent that clever independent certification always contains a self-assessment component. However, **both aspects are simultaneously important according to the responses and therefore a mixed approach was proposed.** Self-assessment would be a lightweight option as it could be run more frequently where independent certification is

seen more complex. **Regular self-assessment would help local decision-making, while external certification could be carried out on longer intervals.**

An additional suggestion was that self assessment could come first, so to ensure inclusion and coverage, which should be a priority in an initial stage, and the certification would come at a later stage to consolidate the results and make them more comparable.

2.4 Exhaustiveness

As described in Figure 6 below, **74% of the respondents consider the indicators exhaustive,** while 26% of respondents disagreed on the statement.
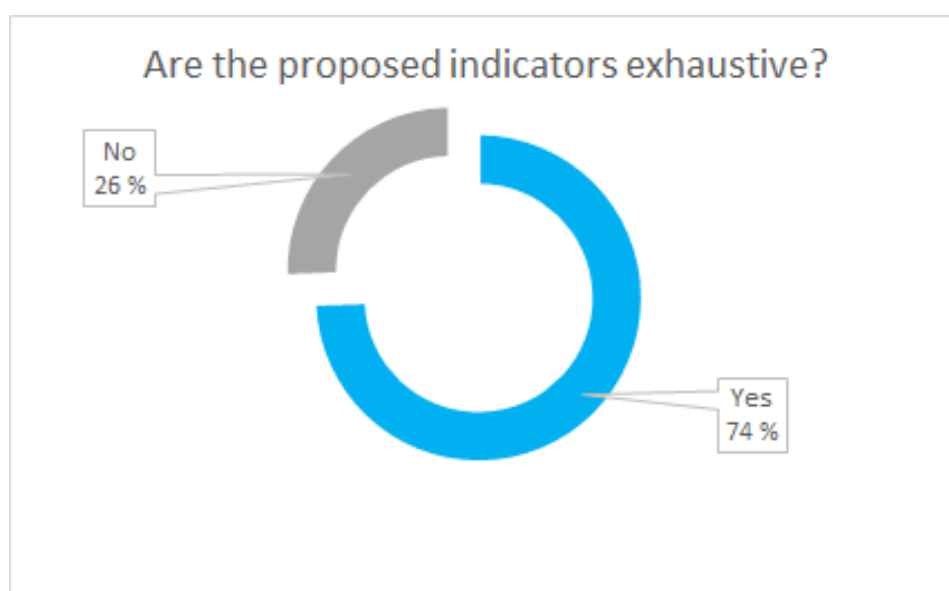
Figure 6: Exhaustiveness of the proposed indicators.

The respondents who disagreed on the statement mentioned the following points for explaining their opinions. Several respondents during the consultation, and also in occasion of the ensuing discussion at the Landscape Validation Workshop, highlighted that it would be ideal to advocate for fewer, **machine-measurable KPIs,** although in practice this suggestion is not easy to follow as respondents seem not to agree on which ones should be selected.

One suggestion was to add **science domains to showcase interdisciplinarity**. According to the comments of some respondents, the list of indicators would need to be **open, in order to accommodate future developments of EOSC.**

Indicators related to funding and RoI were highlighted among the responses as well. It was mentioned by a respondent that there is a need for an indicator for **automatic FAIR dataset production at all main RIs and Public Labs**. It was also suggested to include indicators of **usage of EOSC services by users in a country,** as it would be a useful way to measure engagement and participation. Also, basic cost information should be amended and communicated. However, it was mentioned by some respondents that **it may be impossible to decide if the proposed indicators would be the right ones before the EOSC implements its policies and rules.**

2.5 Challenges of the EOSC Readiness Indicators: Opportunities and Barriers

In the comments that were collected during the 2nd round of consultation, various interesting and important aspects were pointed out.

2.5.1 Risks and Challenges

Among the major risks identified is that the lack of regularity in the monitoring, which might cause dead ends in the worst-case scenarios. Another **risk, pinpointed by more than one respondent, is that monitoring may become either a lobbying instrument, a micromanagement exercise or a source of unhealthy competition,** instead of a useful comparison for harmonizing the implementation. In addition, it was emphasised that **it is required to introduce further levels for indicators without leaving out the interconnection with FAIR principles for improving their usability**.

Some indicators, like the number of users of particular Research Infrastructures, also need some context to be evaluated correctly: in the example, the challenge remains to compare them without knowing the pool of potential users in different specific domains.

Another challenge emphasised among the responses is that the potential value of the proposed indicators is seen as challenging in assessing before the EOSC policies as well as rules have been defined.

Finally, the centralised approach to indicators discussed above, with a European entity being responsible for evaluating KPIs, was also identified as a potential challenge, for its more complex approach than the self-assessment process.

2.5.2 Opportunities and Requests

According to some comments, the **EOSC must not be evaluated only by numbers but also through use cases and success stories.**
On the other hand, it was highlighted that **the amount of indicators should remain low** in order to enable frequent updates of the amounts, for example on an annual basis. There was a statement among the responses that in order to become useful and relevant, the numbers of KPIs should be low, so that not to lose time in collecting and analysing them.

The proposed indicators were generally considered interesting for monitoring the progress. However, **the importance of assessing the distinction between the mandatory and optional indicators was highlighted**, with this aspect especially crucial in the beginning, as

some countries may not have the entire information available, and should be free to evaluate whether there is a need to obtain a certification.

Some respondents stated that the information should be provided at various levels, such as on national service provider levels, hence a high number of stakeholders should be engaged. It was also suggested that **a flexible framework would be required in order to provide comparability among various stakeholders, while simultaneously respecting their differences.** Hence, **the metrics associated with the indicators should be developed in collaboration of all the stakeholders.** The example offered for this need is the number of users for a particular RI , which would be hard to compare without knowing the pool of potential users in a given domain, which could vary greatly.

One respondent suggested that an indicator on data quality/reliability/robustness (as opposed to corruption by data services that may generate new "modified" datasets making reference to originals that are not such anymore), should be included. The motivation is that mechanisms for motivated removal of datasets are a key to reliably reusing data, as the interdisciplinary usage would make it much harder to evaluate the validity of outcomes based on usage of partly unreliable dataset**.**

One respondent suggested that indicators could be ranked at national and institutional levels as it would lead to healthy competition. The issue of competition however is complex and many expressed concerns that comparison without enough context and possibility to provide qualitative information would be misleading, so this aspect should be approached carefully. An additional recommendation by some respondents is that indicators should remain **on a high level, for capturing the diversity rather than details.** It was noted that some of the indicators are strongly dependent on the context as it depends on the metadata quality. Therefore, **there is a request for creating connections between indicators.**

3 RESULTS OF EVALUATION ON THE PROPOSED INDICATORS

In this chapter we summarise survey results of the validation of the Readiness Indicators. The respondents (GB delegates, EOSC WG's and RI representatives) provided their preferences on the proposed indicators. The consultation was open but the stakeholder groups were contacted in a targeted way by email. There are five macro key areas they have chosen to approach this topic at which are Architecture, Organisation and Governance, Policies, Infrastructure and Training. As a general remark the size of the country should be considered when analysing indicators: the monitoring shall provide guidance towards common targets, but it shall recognize and allow flexibility adjusting specific paths depending on different national situations.

Indicators could have simply Yes/No/In planning answers but also including the possibility to provide additional descriptive text, therefore **qualitative comments should be enabled to be added into one form**.
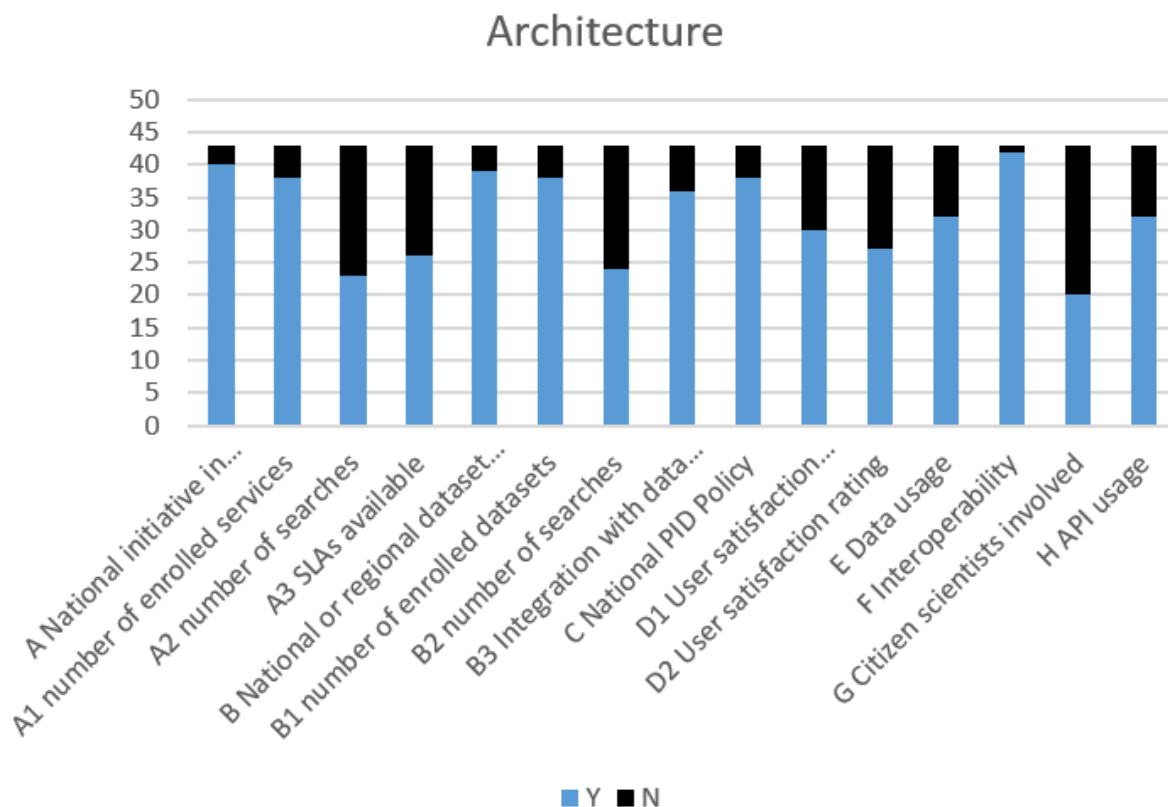
3.1 Architecture

Figure 7: Division of votes for indicators in the field of **Architecture.**

Monitoring of the evolution of national infrastructures and services, supported by a set of relevant key performance indicators (KPIs), is necessary to influence the development of

national environments in order to encourage harmonisation of the national and regional initiatives with pan-European development and allow informed decisions for EOSC implementation. The consultation proposed a number of readiness indicators for Architecture that was scored and commented by the respondents. For a majority of respondents (the 93%), **the availability of National initiative in place** or planned is a key driver for EOSC. To accomplish EOSC architecture, respondents generally agreed (89%) that the number of enrolled **services available in National/Regional registry or other federated mechanisms** is a valuable KPI. It has been recognised that the success of EOSC relies partly on its uptake by thematic infrastructures and the federation of their services.

More than half of the respondents (60%) agreed on the provision of clear descriptions of the service-level agreements (SLAs) as qualified indicators. It has been noticed that SLAs should be captured as a percentage of coverage as well as diversity (i.e. covering different types of needs). A great majority of respondents (91%) agreed that the availability of **National/Regional datasets catalogue(s)** are important indicators for evaluating EOSC readiness: architecture will start from federating the existing architectures. The development of methods and technologies for FAIR-by-design dataset construction is key to EOSC. Otherwise it will remain symbolic and non-competitive with commercial services. The majority of respondents indicated as an impact indicator the number of available datasets (88%) and integration with data catalogues (84%). Regarding data catalogues integration it was noticed the importance of indicating which strategy relies behind it. Otherwise mere integration is not a maturity indicator.

It seems that respondents showed more caution in considering the number of searches as an indicator: 53% are in favour to consider the number of searches for National registries and 56% the number of searches for datasets catalogue. Searches may need to be more elaborated like counting those that remained on the pages, what they searched, results. A website analytics tool to have statistics is also needed.

A majority of the respondents (88%) agreed that **National PID policy is among the primary indicators** and thus a prerequisite to implementing the EOSC architecture.

User satisfaction questionnaire and user satisfaction rating are also indicators highly ranked by 70% and 63% of the respondents.

Gathering and **monitoring usage statistics** across all kinds of resources made available through EOSC is another important element to be considered among indicators: 74% of the respondents agreed on data and APIs usage.

Interoperability is a key factor for EOSC realization: 98% of the respondents agreed on 'interoperability' as an indicator. Achieving a good level of interoperability within EOSC is essential to federate services and provide added value for users, across disciplines, countries and sectors. It was pointed out that interoperability is connected with the integration with other data catalogs so it depends how this indicator will be built in practice, taking into account different aspects on technical, semantic and legal levels.

The number of Citizen scientists indicator will be relevant in a second phase.

Table 1: Percentage of respondents agreeing on proposed indicators for **Architecture.**

	Proposed Indicator	% of respondents agreed

| A	**National initiative in place/planned**	93
B	**National (regional) registry or other federation mechanisms for data in place/planned**	
B1	Number of enrolled services	89
B2	Number of searches	53
B3	SLAs available	60
C	**National (regional) dataset catalogue(s) in place/ planned**	91
C1	Number of enrolled datasets	88
C2	Number of searches	56
C3	Integration with data catalogues	84
D	**National PID Policy**	88
E	**User satisfaction**	
E1	User satisfaction questionnaire	70
E2	User satisfaction rating	63
F	**Data usage**	74
G	**Interoperability**	98
H	**Citizen scientists involved**	47
I	**API usage**	74

3.2 Organisation & Governance
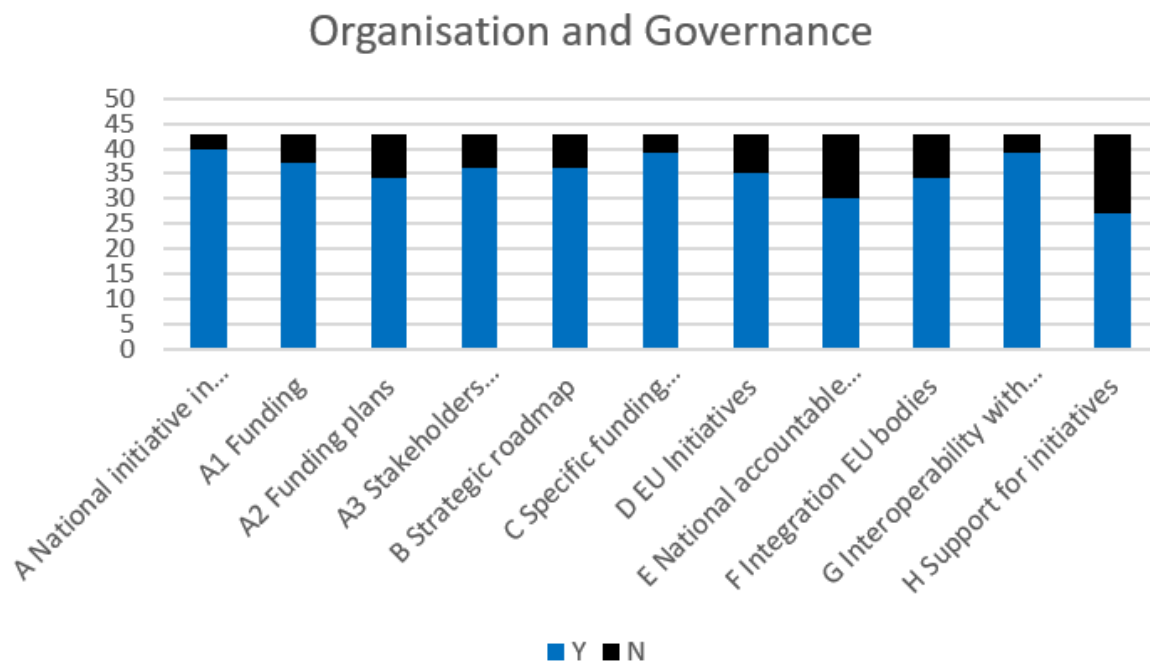
Figure 8: Division of votes for indicators in the field of **Organisation and Governance.**

Given the self-governance model chosen for EOSC implementation, it's clear that its success is based on the efficient and sustainable national and regional initiatives, developed within a pan-European framework, with the participation of the EC. The majority of the respondents (93%) agreed that National initiative in place or planned is therefore a prerequisite to guarantee EOSC organisation and governance. A flexible and sustainable governance model for EOSC must ensure the long-term sustainability of core centralised services and the federated ones, provided by the national/regional initiatives and by the research infrastructures. In this sense the majority of the respondents envisaged in related-funding issues a group of important indicators: 86% agreed on funding, 79% on funding plans and the 91% on specific funding projects. Stakeholders involvement is also a higher indicator for measuring EOSC's organization readiness.

The availability of a strategic roadmap to direct EOSC future implementation, is an important indicator for the 84% of the respondents. But it was mentioned that verifying the alignment with international strategy is also important having monitored its existence. The 81% agreed upon EU initiatives as an indicator to qualify EOSC readiness: EU policies, projects and funding support alignment and interoperability of policies and infrastructures necessary to promote Open Science globally. **Regarding 'funding models', the in-kind contribution of members would be required among the indicators, as noted by respondents.**

The **existence of a National accountable body**, defining and implementing EOSC-related policies and strategies, is ranked by 70% of the respondents. The 79% agreed on integration of EU bodies. It has been noticed that the National accountable body and Integration in the EU bodies are indicators that should be contextualized with the country. One reason could be because governance issues are depending on the regional/federal competencies and it could be hard to answer "yes" or "no".

Achieving a good level of interoperability within EOSC is essential to federate services and provide added value for users, across disciplines, countries and sectors and Interoperability with trans-national initiatives is another clear indicator scored by 91% of the respondents. According to the draft EOSC Interoperability Framework[35] it could be useful to monitor the four layers of interoperability adding indicators for technical, semantic, organisational and legal aspects. 63% agreed on Support for initiatives as an indicator for monitoring alignment and interoperability of policies and infrastructures necessary to promote Open Science globally. For the further actions, more detailed indicators would be required to monitor the establishment process.

Table 2: Percentage of respondents agreeing on proposed indicators for **Organisation and Governance.**

	Proposed Indicator	**% of respondents agreed**
A	**National initiative in place/planned**	93
A1	Funding	86
A2	Funding plans	79
A3	Stakeholders involved	84
B	**Strategic roadmap**	84
C	**Specific funding programmes**	91
D	**EU Initiatives**	81
E	**National accountable body**	70
F	**Integration EU bodies**	79
G	**Interoperability with trans-national initiatives**	91
H	**Support for initiatives**	63

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[35] EOSC IF https://www.eoscsecretariat.eu/eosc-liaison-platform/post/eoscinteroperability-framework-out-comment
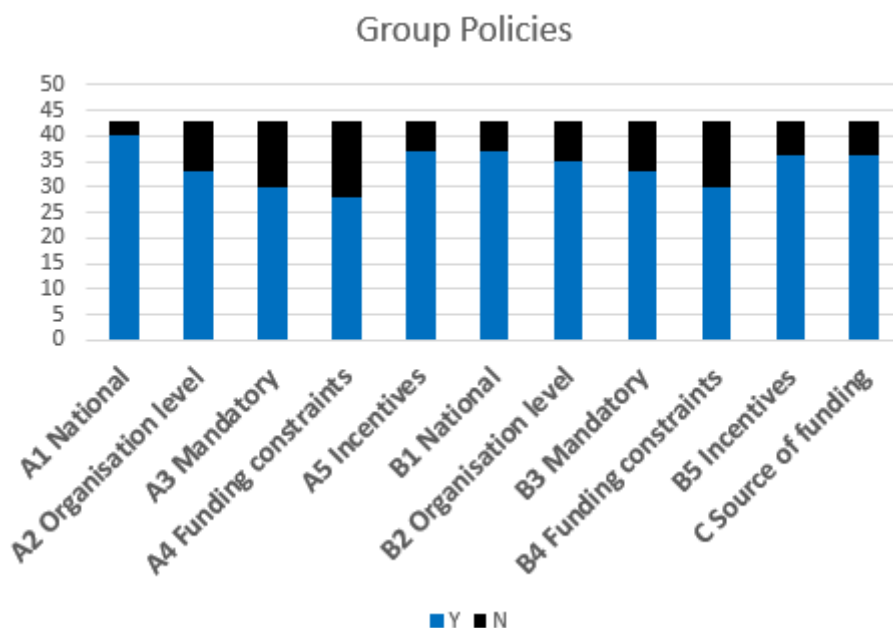
3.3 Group Policies

Figure 9: Division of votes for indicators in the field of **Group Policies.**

In general, most of the respondents supported all the proposed indicators related to Group Policies. 93% agreed on the existence of National policy on Open Science/FAIR data as indicator for monitoring proper implementation of EOSC. It has been noticed that **FAIR and Open should not be conflated** as they are not the same thing.

Another commenter pointed out that while the existence of the policy is one indicator, **the content of the policy will be far more important**, hence a consistent way to describe policies and their content and to make these contents machine readable is required.

Other indicators on policies are at Organisation level (77%) ensure that policies are developed collaboratively; Mandatory (70%) Funding constraints (65%), Incentives (86%) and Source of funding (84%) are also clear indicators for monitoring the effectiveness of such policies.

Table 3: Percentage of respondents agreeing on proposed indicators for **Group Policies.**

	Proposed Indicator	% of respondents agreed
A	**OS/FAIR policies supported/ monitored/ planned**	
A1	National	93
A2	Organisation level	77
A3	Mandatory	70
A4	Funding constraints	65
A5	Incentives	86

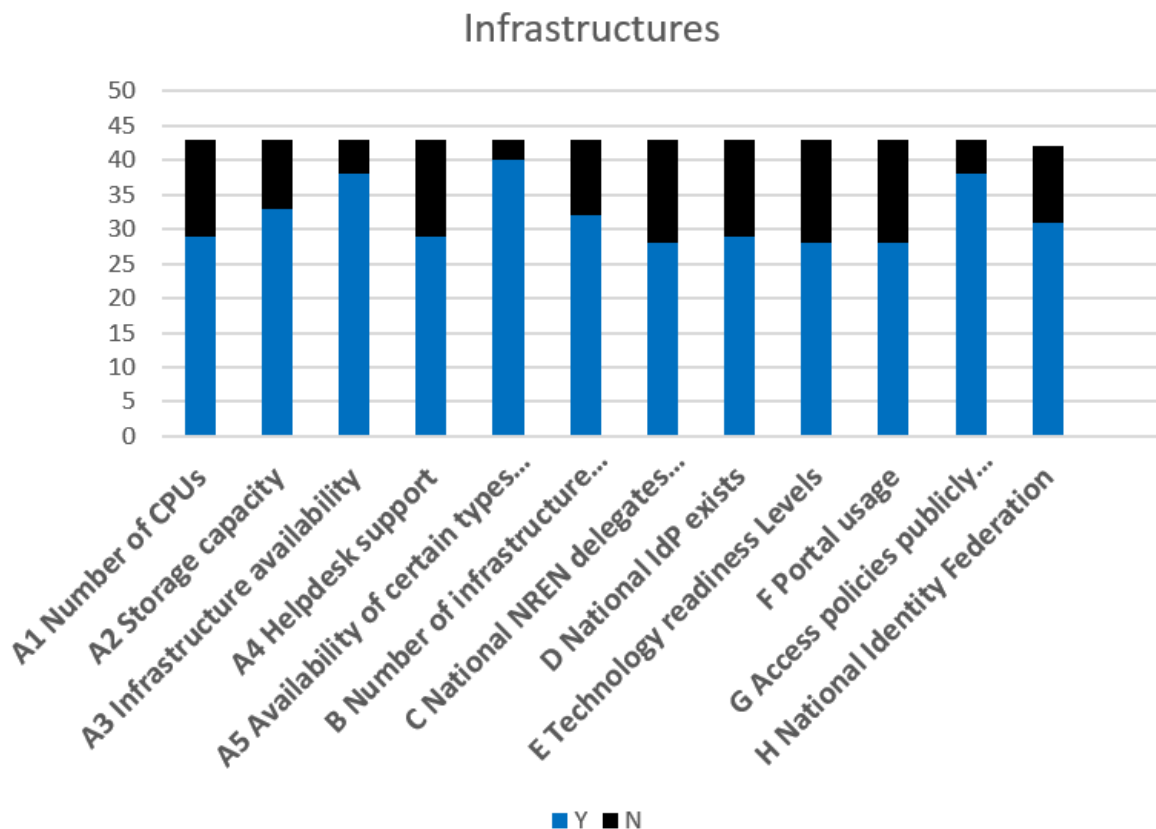| B	DM policies in e/supported/ monitored/ planned	
B1	National	86
B2	Organisation level	81
B3	Mandatory	77
B4	Funding constraints	70
B5	Incentives	84
C	**Source of funding**	84

3.4 Infrastructure

Figure 10: Division of votes for indicators in the field of **Infrastructures.**

The group of indicators for monitoring of EOSC infrastructure resources at national and institutional levels were well accepted by the respondents. 93% agreed on availability of

certain types of services; 88% on Infrastructure availability; 77% Storage capacity, and 67% on Number of CPUs and Helpdesk support.

Even if the **Number of Infrastructure users** was scored by 74%, it has been noted that this could be misleading as numbers vary greatly across domains. Perhaps a percentage of potential users from the target community might be better. In general, it was noted that even if normalised sizing indicators should be introduced, the value of detailed numerical information should not be overestimated as this could lead to gaming and misinterpretations. One commenter offered that normalised numbers i.e. per researcher or number of the country do not provide more than very rough hints on the situation and may create more damage than benefits if not understood in context. As discussed elsewhere in this document, this preoccupation of tempering the quantitative information with explanations and qualitative information is widespread among respondents and it is certainly a factor to be considered when deciding which indicators should be selected.

65% agreed on National NREN delegates security and user management policies, 67% of National IdP exists, 72% National Identity Federation: these are important indicators for infrastructures that implement consistent user experience for authentication and identification across the e-science ecosystem.

65% agreed on technologies readiness levels and portal usage. These are also meaningful indicators and a participant commented that "we need to identify what is the minimum we expect from infrastructures and then develop a common framework for reporting against KPIs. The ongoing ERIC Forum project as well as ESFRI and EC efforts to develop common KPIs could be useful for informing what should be reported and how it should be reported".

A great majority (88%) agreed on access policies publicly available, as an indicator.
Consultation participants suggested as indicators:
- "A clear business plan addressing the goals of EOSC-based activity/traffic on the infrastructure after 5, 10, 15 years must be in place. EOSC starts as a "parasitic" service built on existing hardware that was planned and implemented for research scope in the pre-EOSC period. It is not clear how long the existing capacity will be adequate to host a significant volume of EOSC activity".
- "Basic cost information for the infrastructure is also vital, especially when there is discussion about procuring commercial commodity services. The cost information provision should follow a simple methodology (e.g. efiscal.eu)."

Table 4: Percentage of respondents agreeing on proposed indicators for **Infrastructures.**

	Proposed Indicator	**% of respondents agreed**
A	**Resources**	
A1	Number of CPUs	67
A2	Storage capacity	77

A3	Infrastructure availability	88
A4	Helpdesk support	67
A5	Availability of certain types of services	93
B	**Number of infrastructure users**	74
C	**National NREN delegates security and user management policies**	65
D	**National IdP exists**	67
E	**Technology readiness Levels**	65
F	**Portal usage**	65
G	**Access policies publicly available**	88
H	**National Identity Federation**	72

3.5 Training and Skills
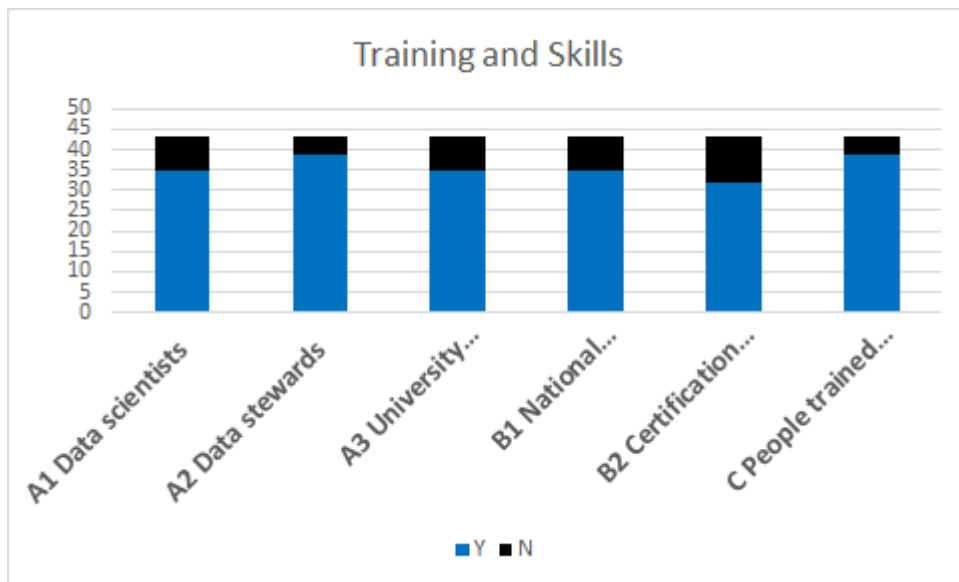
Figure 11: Division of votes for indicators in the field of **Training and Skills.**

In general, the most of the respondents agree on all the proposed indicators related to the Skills and Training. Related to the questions of national or regional curricula to be in place or planned in compliance with international, majority (81%) agreed to count the amount of data scientists as well as university courses and graduates. Even a stronger majority (91%) agreed on maintaining data stewards as one of the indicators for Skills and Training.

The other aspect of indicators for Training and Skills is related to the basic training available for researchers and research support staff. Therefore, 81% or respondents agree on

monitoring indicators as national competence centres. A slightly lower majority (74%) agrees on certification of competencies. However, a strong majority (91%) of respondents consider the amount of people trained per year to be counted as an indicator.

Table 5: Percentage of respondents agreeing on proposed indicators for **Training and Skills.**

	Proposed Indicator	**% of respondents agreed**
A	**National/regional curricula in place/planned (compliance with international?)**	
A1	Data scientists	81
A2	Data stewards	91
A3	University courses & graduates	81
B	**Basic training available for researchers & research support staff**	
B1	National competence centres	81
B2	Certification of competencies	74
C	**People trained per year**	91

3.6 Prioritization of indicators

In order to provide an overview of the main indicators emerging from the consultation, below is reported an initial list of the indicators prioritized according to the highest rankings of respondents which gained more than 80 percent each.

Table 6: List of proposed indicators that over 80 percent of respondents voted on.

Architecture	
1	National initiative in place/planned
2	National (regional) registry or other federation mechanisms for data in place/planned: ● Number of enrolled services
3	National (regional) dataset catalogue(s) in place/ planned ● Number of enrolled datasets ● Integration with data catalogues
4	National PID Policy

5	Interoperability

Organisation & Governance

6	National initiative in place/planned ● Funding ● Stakeholders involved
7	Strategic roadmap
8	Specific funding programmes
9	EU Initiatives
10	Interoperability with trans-national initiatives

Policies

11	OS/FAIR policies supported/ monitored/ planned ● National ● Incentives
12	DM policies in e/supported/ monitored/ planned ● National ● Organisation level ● Incentives
13	Source of funding

Infrastructure

14	Resources ● Infrastructure availability ● Availability of certain types of services
15	Access policies publicly available

Training and Skills

16	**National/regional curricula in place/planned (compliance with international?)** ● Data scientists ● Data stewards ● University courses & graduates
17	**Basic training available for researchers & research support staff** ● National competence centres
18	**People trained per year**

4. HIGHLIGHTS OF THE SURVEY RESULTS

The highlights below on the lists are based on the responses appeared in the 2nd Round of consultation results. The indicators to assess EOSC Readiness within MS and AC have been proposed in five macro key areas which are; Architecture, Organisation and Governance, Policies, Infrastructure, Training and Skills.

The statements of this document remain dynamic and living as considered during the development of EOSC. As mentioned on the SRIA[36], also KPIs should be tested by using RACER criteria (Relevant, Accepted, Credible, Easy to monitor and Robust) which is also recommended in the Country Sheets Analysis[37] for the EOSC Readiness Indicators.

4.1 Responsibilities

On the table 7 below there are listed highlights of the survey for the EOSC community to consider for future responsibility of indicators. The statements of this document remain dynamic since discussion on the indicators is going to continue on various levels with stakeholders and within the EOSC Association.

Table 7: Highlights from the survey results concerning responsibilities.

1	Defining, collecting, analysing, reporting and explaining the indicators on an annual basis should be considered in the **aspect of costs.**
2	The aim would be to have a regular insight at the EOSC readiness in the participating MS/AC, **the exercise is recommended to be done on the European level. The Member States and different national bodies should be involved** in actions and the results should be open to the public. The **qualitative aspect** should include a possibility to describe the situations in words as the specialities in various countries may differ from each other.
3	Responsible organisations could be **NOSCIs** or **mandated organisations**. As a suggestion highlighted in the consultation they could collect the data of indicators at the national level. The EOSC Association would be seen to be the correct facet to collect the data directly from them, in order to compare and to validate the indicators and to maintain monitoring and the infrastructure.
4	The **dashboard approach** would be appropriate for the purpose of publishing information. Therefore, the EOSC Association should receive the mandate to maintain the infrastructure or dashboard

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[36] (2020, July 20). July 2020 - EOSC Secretariat. Retrieved November 9, 2020, from https://www.eoscsecretariat.eu/sites/default/files/open_consultation_booklet_sria-eosc_20-july-2020.pdf

[37] (2020, November 18). Country sheets analysis - Publications Office of the European .... Retrieved December 22, 2020, from https://op.europa.eu/en/publication-detail/-/publication/95e4a900-2a21-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-search

4.2 Monitoring

On the table below there are the results listed that appeared in the consultation concerning monitoring.

Table 8: Highlights from the survey results concerning monitoring.

1	**Maximum level of automation and machine actionability** should remain as solutions to solve the issues concerning the workload that monitoring indicators may cause.
2	**Monitoring should happen yearly on country level.** A neutral actor should be responsible for monitoring. In any case, monitoring should be maintained as a shared effort where the EOSC Association could steer it.
3	**Central harvesting should be maintained at the EU level** where the **collection of the data should be executed at national level.** Therefore, monitoring should be managed both at national and EU levels.
4	A centralized entity for monitoring indicators jointly would be beneficial to manage indicators also at global level.
5	Efficiency of the research investment field should be monitored.
6	Guidelines are required.
7	**Central indicators used should be discussed and evaluated regularly**, with the option of updating their list according to evolving monitoring needs.
8	Monitoring should continue **throughout the EOSC Association's lifetime**.

4.3 Assessment and Certification

Below, on table 9 there is a list summarizing the highlights from the survey provided by the Landscaping Task Force for assessment and certification based on the results of the 2nd Round of Consultation.

Table 10: Recommendations for assessment and certification.

1	51% of the respondents consider self-assessment more useful than independent certification. As both aspects are simultaneously important according to the responses, **a mixed approach** will be proposed by the Landscaping Task Force.
2	**Regular self-assessment** would support local decision-making. **External certification/validation** should be reviewed on a regular basis. To enable the most useful approach for MS/ AC, this topic requires the **engagement of stakeholders** and could **evolve in time** (e.g. self-assessment could come first and be complemented by certification/validation in time).

3	With the independent certification, a **consistent application of methodology** would be ensured.

4.4 Stakeholder Engagement

1	**Metrics** associated with the indicators should be developed **in collaboration of all the stakeholders**.
2	Metrics should remain **quantitative with the possibility for qualitative aspects**.
3	**Flexible framework** would be required in order to provide comparability among various stakeholders yet simultaneously respecting their differences.

4.5 Further Suggestions from Respondents

As appeared from results the indicators should provide a high-level overview of the diversity of EOSC readiness levels within the MS and the AC. Referring to the consultation results, EOSC must not be evaluated only by numbers but also through use cases. FAIR principles should be adopted in indicators as well since the indicators and KPIs should remain objective. Further suggestions referenced to the consultation results are listed on the Table 12 below.

1	Indicators should maintain a **transparent and reproducible measurement** process.
2	Indicators should be **machine-measurable, machine-readable and automatically updated**.
3	Indicators should be **validated** once a year by country references.
4	It would be important to provide indicators related to **usage of EOSC services** by users in a country.
5	Indicators **related to funding and RoI** should be included.
6	**Further levels for indicators** should be introduced without leaving out the interconnection with FAIR principles.
7	Indicators to **disambiguate the different levels of interoperability** should be introduced related to technical, semantic, organisational and legal aspects.
8	**Connections between indicators** should be created.

9	Distinction between the **mandatory and optional indicators** should be assessed.
10	**Science domains** could be used to showcase interdisciplinarity.
11	**Automatic FAIR dataset production** at all main RIs and Public Labs should be included as an indicator.
12	The overall number of indicators should remain **reasonably low**.
13	**Ranking** at national and institutional levels as it would lead into healthy competition.
14	**Open list of indicators** would allow accommodating new indicators for future developments of EOSC.

5 CONCLUSION

In conclusion, **monitoring is seen to continue even after the current composition of EOSC governance[38] and to be transferred to the EOSC Association.** Therefore, NOSCI's and EOSC Association will be expected to implement the indicators together and that the **EOSC Association should receive the mandate to maintain the infrastructure or dashboard** since the indicators are seen as services maintained by EOSC Association.

It is suggested that the organisations most likely to be responsible could be **NOSCI or mandated organisations**, which would collect indicator data at national level where the **EOSC Association would be seen to be the correct facet to collect the data, compare and validate the indicators and to maintain the infrastructure and therefore, also responsible for monitoring.** However, the work remains as living documents and the indicators remain as dynamic and living proposals.

The metrics should be pondered as some of them are considered relative instead of absolute such as a number of researchers in a country. **KPIs will mainly remain quantitative although qualitative comments should be enabled to be added into one form.** Next it will be considered **which indicators would be able to be updated automatically**. As appeared in the consultation results, the Landscaping Task Force will make **proposals for qualitative forms of indicators** as well. It has been discussed that perhaps the **indicators could be validated once a year by country references**.

As recommended by a high number of respondents that the **KPIs should be machine readable and automatically updated wherever possible**. The KPIs must remain as dynamic as possible. In addition, a compendium of data could be used in maintaining the process. **In order to publish information, the dashboard approach would be appropriate for the purpose**.

After publishing this report, the Landscaping Task Force will further elaborate the prioritization of indicators for monitoring preparedness of MS/AC, providing measurement of how a country functions at an early stage and indicators for monitoring KPIs, providing measurements of more granular functions in a later stage, when certain, if not all of those functions are in operation. The goal is to distinguish indicators that assess a given stakeholder's readiness to participate in EOSC from those that will assess performance related aspects of EOSC participation.

More work is needed to compare and integrate sets of indicators emerged after the consultation and briefly presented in Annex 4 and to provide recommendations to compare data appearing from the indicators.

Therefore, further discussion and planning would still be required at governance and EU levels after publishing this document.

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[38] (n.d.). Governance | EOSC Portal. Retrieved October 22, 2020, from https://www.eosc-portal.eu/governance

6 ABBREVIATIONS

For further information, please see the **Official EOSC Glossary**[39].

AC	Associated Country to Horizon 2020
API	Application Programming Interface
COAR	Confederation of Open Access Repositories
CoI	Conflict of Interest
CPU	Central Processing Unit
DOI	Digital Object Identifier
EB	Executive Board
EOSC	European Open Science Cloud
EU	European Union
FAIR	Findable, Accessible, Interoperable, Re-usable
GPU	Graphics Processing Unit
HPC	High-Performance Computing
HTC	High Throughput Computing
IdP	Identity Provider
IR	Integrated Roadmap
MS	Member States
NOSCI	National Open Science Initiative
NREN	National Research and Education Network
OS	Open Science
PID	Persistent Identifier
RI	Research Infrastructure
RoI	Return on Investment
SLA	Service-Level Agreement
SRIA	Strategic Research and Innovation Agenda
TF	Task Force
TRL	Technology Readiness Level
WG	Working Group

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[39] (n.d.). EOSC Glossary | EOSC Portal. Retrieved October 30, 2020, from https://www.eosc-portal.eu/glossary

ANNEXES

ANNEX 1: Questionnaire for 2nd Round of Consultation

1. Monitoring a set of common indicators on a regular basis (at least once a year) at the Country level would help assessing the progresses of EOSC within the MS. Do you agree with this statement?
   a. Yes
   b. Partly/No, why?

2. In your opinion, should the monitoring be managed at a National or the EU level?
   a. National, why?

   b. International, why?

   c. Both, why?

   d. Other, please indicate

3. 35 % of the respondents have said National OS Initiatives should be responsible for monitoring the indicators. Do you agree on this statement?
   a. Yes
   b. No, why?

4. 89% of stakeholders stated the measurements should be public (with possible exceptions for sensitive information to be restricted). Do you agree with the statement?
   a. Yes
   b. No, why

   If yes, which information would you exclude from the public domain?

Open response

5. Below you will find the proposed indicators according to the themes.

Please tick all the ones you think are relevant.

Architecture	Yes	No
A. National (regional) registry or other federation mechanisms for data in place/planned		
a1 Number of enrolled services?		
a2 Number of searches?		
a3 SLAs available?		
B. National(regional) dataset catalogue(s) in place/planned		
b1 Number of enrolled datasets?		
b2 Number of searches?		
b3 Integration with other data catalogues		
C. National PID policy in place/planned		
D.1 User satisfaction (questionnaire)		
D. 2 User satisfaction (rating)		
E. Data usage (n° of citations)		
F. Interoperability (checklist)		
G. N° of Citizen scientists involved		
H. API Usage		
Additional comments if any:		

Organization and Governance	Yes	No
A. National Initiative in place/planned/etc.		
a1. Funding – structural, internal, per project.		
a2. Funding plans		

a3. Stakeholders involved (number, type)		
B. Strategic roadmap (IR, OS, etc)?		
C. Specific funding programmes for OS/EOSC/data science?		
D. EU initiatives		
E. National accountable body		
F. Integration in the EU bodies		
G. Interoperability with trans-national initiatives		
H. Support for PlanS/COAR/other such initiatives		
Additional comments, if any:		

Group Policies	Yes	No
A. OS/FAIR policies supported/ monitored/ planned		
a1. National		
a2. At the organisation level		
a3. Mandatory/formal/informal		
a4. Funding constraints		
a5. Incentives		
B. DM policies in e/supported/ monitored/ planned		
b1. National		
b2. At the organisation level		
b3. Mandatory/formal/informal		
b4. Funding constraints		
b5. Incentives		
C. Source of funding		
Additional comments, if any:		

Infrastructures	Yes	No
A. Resources		
a1. # of CPUs		
a2. Storage capacity		
a3. Infrastructure Availability 7/24		
a4. Helpdesk support 7/24		
a5. Availability of certain types of infrastructure services to researchers (HPC, storage, HTC, GPUs, remote access to science facilities...)		
B. # of infrastructure users (individuals, organisations)		
C. National NREN delegates security and user management policies?		
D. National IdP exists?		
E. TRLs		
F. Portal usage (Clicks/downloads or other usage stats)		
G. Access policies publicly available to access RIs		
H. National Identity Federation in place		
Additional comments, if any:		

Training and Skills	Yes	No
A. National/regional curricula in place/planned (compliance with international?)		
a1. Data scientists		
a2. Data stewards		
a3. How many university courses? How many graduates?		
B. Basic training available for researchers & research support staff		
b1. National competence centres		

b2. Certification of competences?		
C. Number of people trained per year.		
Additional comments, if any:		

6. Overall, do you think that the proposed indicators are exhaustive?
    a. Yes
    b. No

    If no, which one(s) would you recommend to add?

7. Please indicate any additional comments concerning the indicators that might come in your mind.

8. 50% of respondents consider self-assessment would be enough, and 38% of responses indicate there should be Certification on EOSC level. In your opinion, which option would be more effective?
    a. Self-assessment
    b. Independent certification

    Additional comments

ANNEX 2: Anonymised data received from the second round of consultation

Anonymised data received from the second round of consultation available on the NextCloud of the EOSCsecretariat.eu[40].

ANNEX 3: References for Indicators Outside of This Report

In order to bring the proposal of the EOSC Readiness Indicators into a wider context within EOSC, on this Annex there are listed some examples of discussions of different indicators in various parts of EOSC.

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[40] https://repository.eoscsecretariat.eu/index.php/s/MpbgBfSCRajrgqy

As discussed during the session, "All You Need to Know About the EOSC European Partnership & Association" and interactive discussion on the results of the SRIA Consultation[41] in the EOSC Symposium on 19 October 2020. According to the SRIA Open consultation results, it appeared the metrics and indicators currently remain on low priority in EOSC development. The reason for it was discussed during the EOSC Symposium[42] where it was stated **there are various concerns about metrics such as on how to apply and measure data in FAIRNess**.

Country Sheets Analysis[43] of the EOSC Executive Board Working Group Landscape proposes recommendations for emerging indicators. The analysis recommends the indicators should be assessed clearly in the aspect of what information is required and what use case the indicators address. The aim is to improve the maturity of stakeholders' resources instead of judging. In order to ensure measurability of FAIR performance, clear benchmarks should be defined for the indicators in collaboration with representatives from domains. The analysis states that detailed use cases would have a crucial role in development processes for indicators. It would be important to consider the evidence required for demonstration of and agreement of the progress of indicators with stakeholders. In order to populate EOSC readiness profiles, the sources of open data among various stakeholders should be decided. A valuable solution would be to engage with providers of open data as it would ensure the provided information to be of use in assessing EOSC readiness.

There are synergies between the recommendations provided by the Country Sheets Analysis and the designation of the proposed readiness indicators by the surveys conducted by the Landscaping Task Force.

1. Set of Indicators by NI4OS-Europe

In the case a National Open Science Cloud Initiative (NOSCI) does not exist, an extra set of indicators is required to support and monitor the establishment of a NOSCI.

Deliverable 2.2 "National OSC initiatives models" of NI4OS-Europe project, includes the Blueprint for the establishment of the NOSCIs and specifically, it presents indicative indicators to measure the progress of the NOSCIs establishment, the workflow for setting up the initiatives, as well as their operational aspects.

The suggested indicators are in line with the EOSC Readiness Indicators and may be used as a guide to complement the establishment and operation of a NOSCI. The proposed framework is both agile and expandable to successfully address any countries-specific needs.

The proposed metrics are categorized in four distinct categories:

- The first category: "NOSCI organization" is focused on organizational, administrative and legal aspects of the NOSCI.

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[41] (n.d.). Programme | EOSCSecretariat. Retrieved October 22, 2020, from
https://www.eoscsecretariat.eu/eosc-symposium-2020-programme

[42] (2020, October 19). EOSC Symposium 2020 | EOSCSecretariat. Retrieved October 22, 2020, from
https://www.eoscsecretariat.eu/eosc-symposium-2020

[43] EOSC Executive Board Working Group Landscape. 2020. Country Sheets Analysis.
https://op.europa.eu/en/publication-detail/-/publication/95e4a900-2a21-11eb-9d7e-01aa75ed71a1/language-en/format-PDF/source-search

- The second category: "Infrastructure" is focused on the core infrastructure aspects: the infrastructure itself and its operations.
- The third category: "Training and Skills" assesses the nature and spread of the training activities within the NOSCI community.
- The fourth category: "Sustainability and international collaboration" is focused on financial issues related to long-term sustainability of the NOSCI, as well as its relationship with international organizations, specifically in terms of sustainability at European level.

All four main categories have been accompanied by sub-categories of indicators that provided a higher granularity.

A. NOSCI Organisation

1.a. Set-up Metrics
       1.a.1. NOSCI established [Yes [Date]/No]
       1.a.2. NOSCI initiating body [Name, Type]
       1.a.3. NOSCI set-up document [Description, URL]
       1.a.4. NOSCI mandate duration [Period/Date]
       1.a.5. NOSCI set-up event carried out [Date, Type of event]

1.b. Organizational Metrics
       1.b.1. Form of organization: [task force / consortium / national programme /professional association / standalone organization / legal entity / other]
       1.b.2. Nomination of the representative [Description / Name, Date]
       1.b.3. Establishment of the Coordination body / decision making mechanism [Name, Description]
       1.b.4. NOSCI recognition at the national level [Document, Date]

1.c. Membership
       1.c.1 Membership: number of organizations [number]
       1.c.2 Membership: type of organizations [Number of: Academic / Research / Non-profit/ Commercial/ Other Organizations]

1.d. NOSCI Documents
       1.d.1. National OSC Strategy document existence (Yes [(URL, Date of Establishment]/No)
       1.d.2. Strategic roadmap (Yes [(URL, Date of Establishment]/No)
       1.d.3. National / Institutional policies around Open Science (Yes [Content, URL, Date of latest update]/No)

B. Infrastructure and Services

2.a. Infrastructure Metrics
       2.a.1.Number and Type of infrastructures (Number and Type [National Roadmap infrastructures (ESFRIs), Other national e-infrastructures, Other Research Infrastructures])
       2.a.2.Access policies in place (Yes (URL, Date of establishment/latest update]/No)
       2.a.3.Number of CPU cores [number]
       2.a.4.Storage size [number in TB]

2.b. Services Metrics

2.b.1.Number of services offered [number/type of services (generic, thematic, operational)]
2.b.2.Enrolled services [number/position in MVE (EOSC-Exchange/EOSC-Core)]
2.b.3.National SLAs in place [number]
2.b.4.Integration with national AAI federation [number]
2.b.5.Services following the FITSM [number/type of services (generic, thematic, operational)]
2.b.6.FAIR-enabling services [number/type of services (generic, thematic, operational)]

2.c. Operational Metrics
2.c.1.National (regional) registry or other federation mechanisms for data in place/planned (Yes [URL, Date of Establishment]/No)
2.c.2.National SLA monitoring [Yes/No]
2.c.3.National Open Science portal [Yes/No]
2.c.4.National Open Science helpdesk [Yes/No]
2.c.5.National Open Science monitoring [Yes/No]
2.c.6.National AAI federation availability [Yes/No]
2.c.7. Security and privacy policies in place (Yes [URL, Date of establishment/ latest update]/No)

2.c.8.Preservation policies in place (Yes [URL, Date of establishment/ latest update]/No)

C. Training and Skills

3.a. Community Metrics
3.a.1National/regional curricula in place/planned (Yes [Description]/No)
3.a.2.Basic training available for researchers & research support staff (eg. National Competence centers) (Yes [(Description]/No)
3.a.3.Number of trained people per year [Number, Thematic coverage]
3.a.4.Number of training material [Number, Thematic coverage]

D. Sustainability and International Collaboration

4.a. Funding Metrics
4.a.1.National Fund for OS/OSC in place/ planned [Yes/ No]
4.a.2.Funding: national OSC project [type: infrastructure/software/services/data/skills; total funds; total FTEs; Duration].
4.a.3.Funding: International and European OSC Projects (type: infrastructure/software/services/data/skills; total funds; total FTEs: number; Duration).
4.a.4. Sustainability plan in place / planned [Yes/ No]

4.b. Metrics Concerning Membership in International Bodies / Fora:
4.b.1.EOSC Association participation (Yes/No)
4.b.2.EOSC pillars participation (Yes [Description, Date of Admission] /No)

4.b.3.Other (Yes [Description, Date of Admission]/No)

2. Other sets of EOSC Indicators from EOSC Marketplace and EOSC SRIA

To complete the overview, the following are some indicators that appeared in reports published after the consultation conducted.

EOSC Marketplace Criteria[44]
"The service is accessible by users outside its original community.;   "The service is described through a common template focused on value proposition and functional capabilities.;   "At least one service instance is running in a production environment available to the user community.;   "Publish Research data is Findable, Accessible, Interoperable and Reusable [reference to FAIR].;   "Release notes and sufficient documentation are available.;   "Helpdesk channels are available for support, bug reporting and requirements gathering."
Some examples of KPIs from the SRIA version 0.8 for KPIs basing on objectives for monitoring[45]
"Existence of standardized national Open Science and FAIR data strategies, including the description of these policies --"   "Existence of central/national contact point for Open Science --"   "Existence of national policy on Open Access publishing and Open Access to publications, and if YES, does it include financial incentives and support schemes? --"   "Existence of national policy on Data and Services, and if YES, does it include Open Access to data including financial incentives and support schemes? --"   "Existence of national policy on Open learning including financial incentives and support schemes --"   "Existence of national, regional, or sectoral research evaluation schemes of universities and RPOs, which account for existing institutional implementation of Open Science principles and Open Access schemes --"

(n.d.). For providers | EOSC Portal. Retrieved December 14, 2020, from https://eosc-portal.eu/for-providers

[45] (2020, October 18). SRIA - EOSC Secretariat. P. 139. Retrieved October 30, 2020, from https://www.eoscsecretariat.eu/sites/default/files/eosc-sria-v08.pdf

- "Existence of reference to EOSC in current national, regional, or sectoral policies" -- "Progression of the of the institutional structure(s) at national level accountable for defining and implementing EOSC related policies and strategies including their hierarchical structure --"

- "Existence of EOSC dedicated funding streams or criteria in national funding mechanisms or programs --"

- "Existence of dedicated funding streams or other measures (Programs, Grant schemes, project support, financial and other incentives), which target the promotion and/or implementation of Open Science principles at institutional level --"

- "Evolution (investment) of the backbone stakeholder(s) at national level, which is contributing to EOSC services (KPI - number of relevant stakeholders in the individual categories, i.e. data infrastructures, e- infrastructures, HPC Infrastructure, data repositories, and other services).. --"

- "Sustainable funding of operation cost for the backbone stakeholder(s) at national level, which is contributing to EOSC services --"

- "Evolution of the Open science mindset at the national or regional level (KPI - number of universities, public and private RPOs, thematic infrastructures, which have adopted OA policies, Number of OA repositories, …) -- "

Areas of businesses that KPIs relate to in the SRIA version 0.8[46]

- Onboarding of resources
- Access to resources
- Composability of resources
- Composability across resource providers
- Community of practise

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[46] (n.d.). SRIA - EOSC Secretariat. p. 122-124. Retrieved December 14, 2020, from https://www.eoscsecretariat.eu/sites/default/files/eosc-sria-v08.pdf
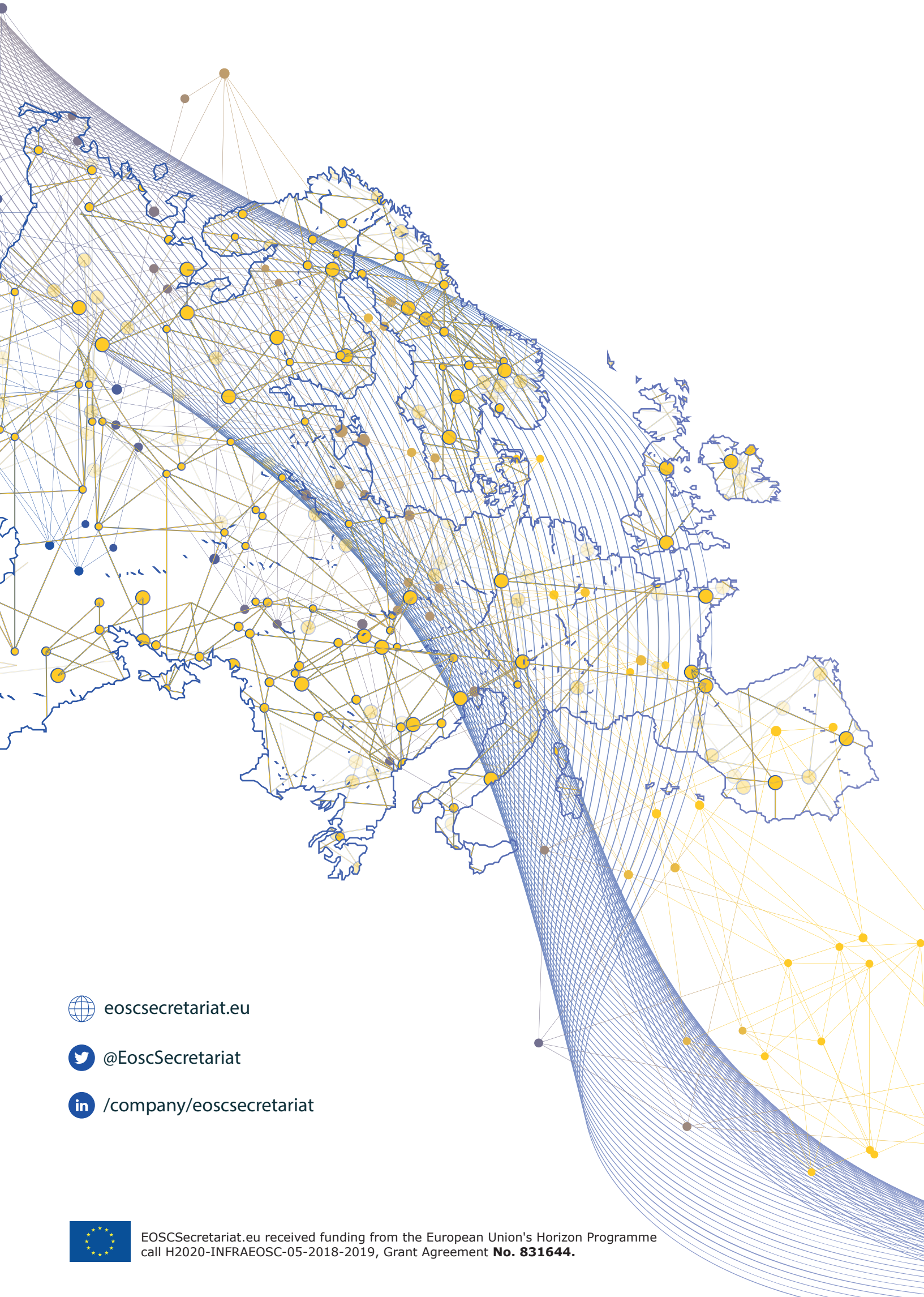
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