EOSC-SYNERGY

Landscaping Country Report Portugal

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Abstract:

This landscape analysis report aims to provide an overview of the policies, practices, roadmaps, and strategies around funding, procuring, providing, accessing, and sharing of services and resources in the EOSC scope in Portugal.

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1 Introduction

1.1 Aim and scope of this landscape analysis

This landscape analysis aims to provide an overview of the policies, practices, roadmaps and strategies around funding, procuring, providing, accessing and sharing of services and resources in the European Open Science Cloud (EOSC) scope in Portugal.

Accordingly, special emphasis will be given to policies and practices in Portugal, which address the needs of different EOSC user groups (individual researchers, citizen scientists, research projects and collaborations, industries and SMEs) with a focus on the user communities that are already part of the national roadmap for research facilities.

The work herein will cover several processes and regulations, namely those dealing with generic services for data production, processing and preservation, as well as those for thematic resources and services that target needs of specific research communities. Transnational access to national resources will also be covered.

The Portuguese landscape analysis focuses on research infrastructures and e-infrastructures. For this purpose, an online survey was developed, using the LimeSurvey platform. This survey was based on the EOSC Pillar's survey[1], which aimed at assessing the state of the art of national initiatives in the area of open research data and services, in order to support harmonisation of these services and ultimately their integration into the EOSC.

The inquired entities are included in the National Roadmap of Research Infrastructures[2]. We observed a total response rate of 71% (37 organisations responded to the survey, from a total of 52).

Additionally, a desk research was performed concerning policies, regulations and funding processes.

1.2 Definition/delimitation of "EOSC compliant resources"

In this section, we will present an overview of the national resources, namely e-infrastructures, research infrastructures, large-scale research facilities and repositories.

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[1] https://www.eosc-pillar.eu/news/pillar-national-initiatives-survey-results
[2] https://www.fct.pt/apoios/equipamento/roteiro/2013/docs/Portuguese_Roadmap_of_Research_Infrastructures.pdf

1.2.1 E-Infrastructure / ICT infrastructure, including partnerships in EGI/EUDAT/PRACE/other

In what concerns e-Infrastructures (Figure 1), namely related to computing, data management and network services, Portugal presents several projects that are in line with European initiatives.
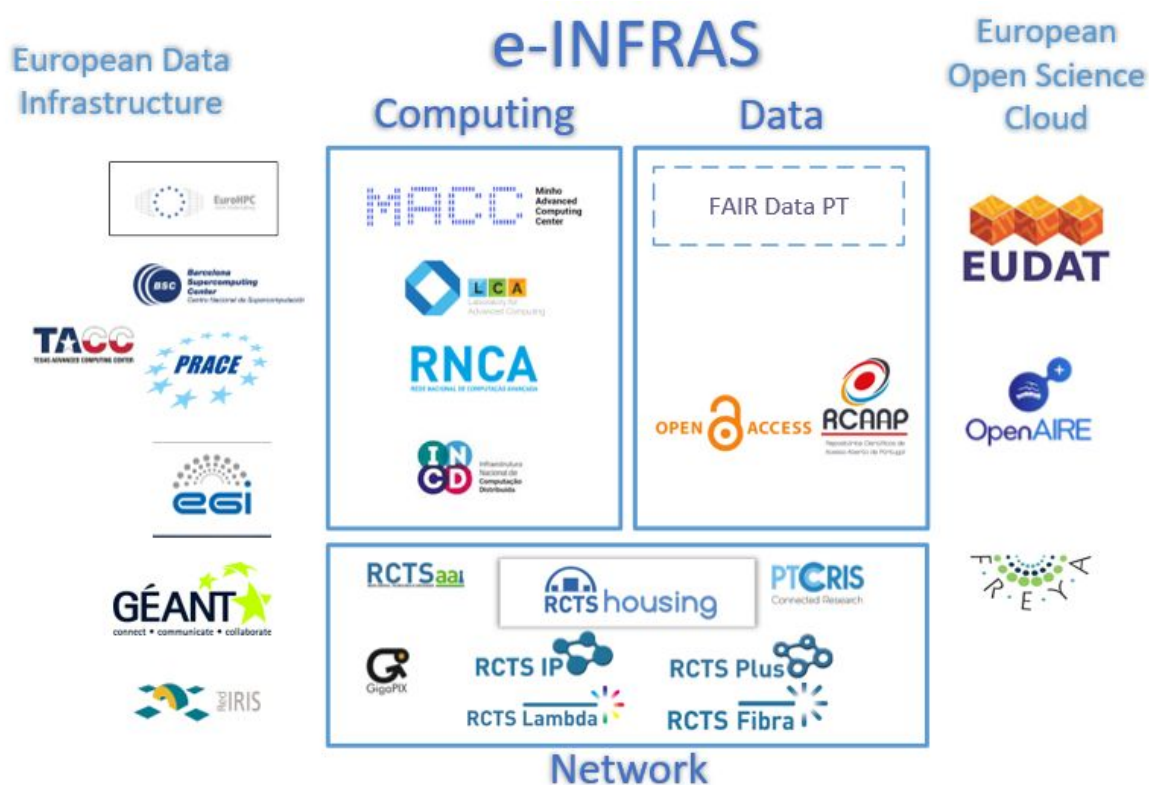

Figure 1 - *National research data e-infrastructures.*

1.2.1.1 Computing

Portugal has been expanding its capacity in advanced computing, through several infrastructures and activities. The largest centres are as follows:

- The **Laboratory for Advanced Computing (UC-LCA)**[3], founded by the University of Coimbra, offers high performance computing (HPC) resources and services within the institution and to the national research community. This infrastructure is a member of PRACE;

- The **National Distributed Computing Infrastructure (INCD)**[4] provides computing and storage services to the scientific and academic community, covering all areas of knowledge. It provides high-throughput computing (HTC), HPC and cloud computing resources and services, and it is involved in several national and international projects. INCD bridges with the European Grid Infrastructure (EGI), the Iberian Distributed Computing Infrastructure (IBERGRID), the Worldwide LHC Computing Grid (WLCG) and also with EOSC (EOSC-hub and EOSC Synergy).
  The organizations providing support to INCD activities are as follows: Laboratory of Instrumentation and Experimental Particles Physics (LIP)[5], the National Laboratory for Civil Engineering (LNEC)[6] and the National Scientific Computing Unit (FCCN)[7], a branch of Foundation for Science and Technology (FCT)[8];

- **Minho Advanced Computing Centre (MACC)**[9] represents a national research support infrastructure intended to support HPC in multiple areas, and large-scale data processing, analysis and visualization;

- The **Engage Square Kilometre Array (SKA)**[10] **Portugal** congregates universities and industry participating in the SKA Consortia bringing the Green ICT concepts to radio astronomy. It is endorsed by the Portuguese government as a major radio astronomy plan. Its approval is a milestone in driving Portugal to consider its full membership to the SKA. Engage SKA Portugal is led by the Institute of Telecommunications, the Universities of Aveiro, Porto, and Évora, and the Polytechnic Institute of Beja;

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[3] https://www.uc.pt/lca

[4] https://www.fccn.pt/en/computing/incd/

[5] https://www.lip.pt/?section=home&page=homepage&lang=en

[6] http://www.lnec.pt/en/

[7] https://www.fccn.pt/en/

[8] https://www.fct.pt/index.phtml.en

[9] https://macc.fccn.pt/

[10] https://engageska-portugal.pt/

- The **National Network of Advanced Computing (RNCA)**[11] provides HPC services to the research, technology and innovation communities. RNCA members and computing resources include MACC, INCD, UC-LCA and University of Évora (Oblivion and Engage SKA).

Please note that major national universities also have computing centres of reference.

1.2.1.2 Data

Portugal has been showing remarkable progress in the Open Access movement over the last 14 years with expansion of the network of repositories of educational and research institutions and an increase in the diversity of e-services and a higher involvement of the scientific community.

The project **RCAAP - Scientific Open Access Repositories of Portugal,**[12] launched in 2008, is an Open Access initiative focused on storage, preservation and access promotion to scientific knowledge produced in Portugal. Through the RCAAP platform, it is possible to access numerous articles from scientific journals, communications, thesis and dissertations deposited within several Portuguese repositories at national higher education entities and other R&D institutions.

The existing data e-infrastructures have implicit the FAIR data principles, making data *F*indable, *A*ccessible, *I*nteroperable and *R*eusable. The partnership with European initiatives, such as EUDAT and OpenAIRE, contributes to this approach.

A strong collaboration with the research communities has been present since the beginning of FAIR activities in Portugal. A dedicated series of workshops, such as the Data Research Management Forums, bring together researchers, data managers and decision makers to promote an integrated approach to data management in Portugal.

The participation in the Research Data Alliance (RDA) initiative, through the RDA-Portugal[13] node, has also contributed to sharing of data best practices and providing adequate knowledge transfer at international level.

1.2.1.3 Network

The **Science, Technology and Society Network (RCTS)**[14] corresponds to the national education and research network responsible for national scientific computing. This network is managed and operated by FCCN. It offers researchers, teachers and students a high-performance digital infrastructure to support

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[11] https://www.fccn.pt/computacao/rnca/

[12] https://www.fccn.pt/en/knowledge/rcaap/

[13] https://www.rd-alliance.org/groups/rda-portugal

[14] https://www.fccn.pt/en/institutional/rcts/

projects on a national and international level. Representing the Portuguese NREN, RCTS is integrated into the GÉANT network.

1.2.1.4 National e-Infrastructures categorization

Based on the landscape analysis from the e-Infrastructure Reflection Group (e-IRG)[15], the national e-Infrastructures might be categorized within the European context as follows:

- <u>Horizontal provisioning</u> - Portugal is included in category C with six provisioning organizations providing the major e-Infrastructure services;
- <u>Coordination level</u> – Portugal presents a well-defined coordination structure, with a single major organization countrywide;
- <u>Governance of networking e-Infrastructure</u> – The governance is under the responsibility of the Minister of Science, Technology and Higher Education (MCTES);
- <u>Governance of computing, data and "other services" e-Infrastructure</u> – The strategic management of these e-Infrastructures is performed by the MCTES conjointly with R&D institutions.

1.2.2 Research Infrastructures

According to the definition of the European Commission, the term research infrastructure refers to "*facilities, resources and services used by the science community to conduct research and foster innovation*"[16]. It encompasses large-scale research infrastructures, arrays of scientific equipment, collections, archives and databases, computational systems, communication networks for Open Access. These may be single-sited, distributed over several locations, cities or countries, or virtual, that is, provided electronically.

One of the main challenges of any research infrastructure is its capacity to provide services to national and international scientific and educational communities, as well as to businesses and industry.

Towards this goal, FCT, the Portuguese public funding agency that supports science, technology and innovation, in all scientific domains, launched in 2013 a call for the creation of the Portuguese Roadmap of Research Infrastructures of Strategic Interest. This brought Portugal into the group of European

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[15] e-IRG, National Nodes - Getting organised - How far are we?; Implementing e-Infrastructures Commons and the European Open Science Cloud; 2018; Available at:
http://e-irg.eu/documents/10920/238968/NationalNodesGettingorganisedhowfararewe.pdf

[16] European Commission, Access to European Infrastructures; Available at:
https://ec.europa.eu/info/research-and-innovation/partners-networking/access-research-infrastructure/european-research-infrastructures_en

countries which have produced their national roadmaps, in alignment with the European Strategic Forum on Research Infrastructures (ESFRI)[17].

1.2.3 Large-Scale Research Facilities

Portugal's adhesion to large international organizations such as the European Laboratory for Particle Physics (CERN), the European Southern Observatory (ESO), the European Synchrotron Radiation Facility (ESFR) and the International Thermonuclear Experimental Reactor (ITER), confirms Portugal's strong institutional commitment to support the national scientific and technological community in its involvement in fundamental and applied international research.

The Portuguese participation in these organizations has contributed to innovation in industrial sectors, represented by companies with high technological intensity and by R&D institutions.

These companies and institutions display a high degree of specialization, differentiated human capital and technological innovation. FCT has gathered their contributions in a catalogue designated as "Portugal Large-Scale Facilities"[18].

1.2.4 Repositories

As previously mentioned, RCAAP is the main Open Access/Open Science initiative from Portugal. It collects aggregates and index Open Access research content from Portuguese repositories and journals. It constitutes a single entry point for searching, discovery and recall of thousands of scientific and scholarly publications, namely journal articles, conference papers, thesis and dissertations. RCAAP was developed and is managed by FCCN, with the technical and scientific collaboration from Minho University[19].

Among other services, RCAAP offers SaS hosting services for repositories (based on DSpace) and Open Access journals (based on OJS). Currently, RCAAP aggregates 52 repositories (27 hosted) and 139 journals (22 hosted).

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[17] https://www.esfri.eu/

[18] FCT; Portugal in Large-Scale Research Facilities; 2014; Available at:
https://www.fct.pt/apoios/tecnologia/docs/catalogo_tecnologia_web.pdf

[19] https://www.uminho.pt/EN

1.3 Information sources on services, repositories, facilities and infrastructures

The Portuguese Roadmap of Research Infrastructures of Strategic Interest constitutes an instrument of stability and sustainability, which allows the coordination of the efforts of regional and national funding entities. It enables:

- The evaluation of existing and emerging research infrastructures in need of support for implementation;
- The development of a strategic plan for investment in research infrastructures;
- The promotion of synergies and funding prioritizing;
- The multilateral initiatives leading to better use and development of research infrastructures at European and international level.

In 2014, forty research infrastructures were recommended for integration in the national roadmap (Figure 2). All these research infrastructures demonstrated both high scientific impact and strategic relevance. In the near future, the selected infrastructures can either be or become national and international reference hubs, in close coordination with international infrastructures. The research infrastructures were distributed across seven different areas:

- 10 in Physical Sciences and Engineering;
- 9 in Biological and Medical Sciences;
- 7 in Social Sciences and Humanities;
- 5 in Environment;
- 4 in e-Infrastructures;
- 4 in the Energy field;
- 1 in Material and Analytical Facilities.
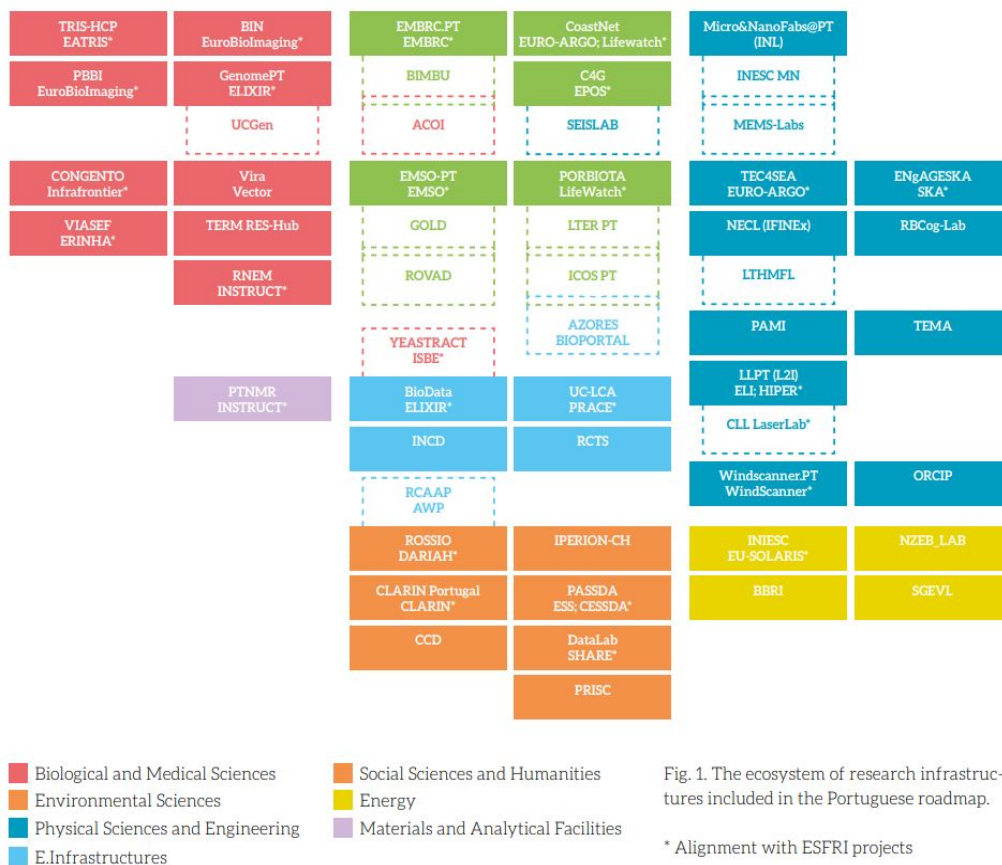
Fig. 1. The ecosystem of research infrastructures included in the Portuguese roadmap.

Legend:
- Biological and Medical Sciences
- Environmental Sciences
- Physical Sciences and Engineering
- E.Infrastructures
- Social Sciences and Humanities
- Energy
- Materials and Analytical Facilities

* Alignment with ESFRI projects

Figure 2 - The ecosystem of research infrastructures integrated in the Portuguese Roadmap.

In 2019, twelve new research infrastructures were added to the roadmap, according to Order n. 4157/2019 [20] and Order n. 7557/2019 [21], related to the following domains:

- 3 in Physical Sciences and Engineering;
- 6 in Biological and Medical Sciences;
- 2 in Environment;
- 1 in e-Infrastructures.

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[20] https://dre.pt/application/conteudo/122109185

[21] https://dre.pt/application/conteudo/124201183

More recently, after the completion of our survey, four new research infrastructures were added to the roadmap, in accordance with Order n. 4958/2020[22] and Order n. 5220/2020[23]. They are all related to Biological and Medical Sciences.

Just recently, it was published the 2020 Update of the National Roadmap of Research Infrastructures[24], which summarizes their development and gives detailed information on each of the research infrastructures, namely regarding the institutional partnership, description, activities and impact. This update presents now the total fifty-six research infrastructures across six thematic areas, in accordance to those of the 2018 ESFRI roadmap:

- 4 in Energy;
- 7 in Environment;
- 20 in Health and Food;
- 14 in Physical Sciences and Engineering;
- 7 in Social and Cultural Innovation;
- 4 in Digital infrastructures.

1.4 Between projects and national institutions

The Portuguese entities consider strategically important to align and participate in international initiatives. Portugal is involved in several global initiatives including EGI, EUDAT, GÉANT, OpenAIRE, PRACE and RDA, and participates in several European collaborative projects.

According to the conducted survey, both research infrastructures and e-infrastructures were asked if they are part of or related to another infrastructure that facilitates integrating their data and services into EOSC.

	Percentage
Yes	40,55%
No	54,05%
Don't know	2,70%
No answer	2,70%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=37.

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[22] https://dre.pt/application/conteudo/132431503
[23] https://dre.pt/application/conteudo/133054412
[24] https://www.fct.pt/media/docs/Portuguese_Roadmap_Infrastructures2020.pdf

Is your infrastructure part or related to another infrastructure which facilitates integrating your data and services into EOSC?
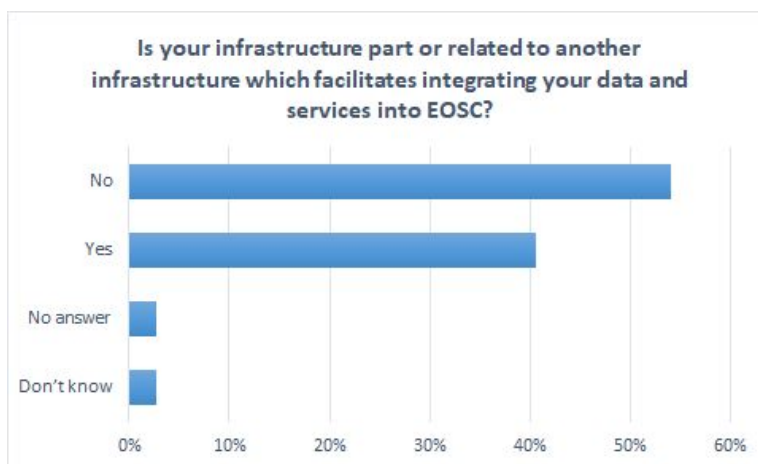
From the thirty-seven infrastructures that were inquired, fifteen are part of or are related to another infrastructure that facilitates integrating their data and services into EOSC, while twenty infrastructures are not.

A desk research was performed in order to describe the bridging between Portuguese research infrastructures and European research infrastructures (Figure 3).

Portuguese Research Infrastructure	European Research Infrastructure
AIR Centre - Atlantic International Research Centre	AIR Centre - Atlantic International Research Centre
BIN - National Brain Imaging Network - Core Infrastructure	EuroBioImaging ERIC - European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences
Biobanco-pt - National Biobanks Infrastructure	BBMRI ERIC - European Research Infrastructure for Biobanking
BioData.pt	ELIXIR PT - Portuguese Distributed Infrastructure for Biological Data	ELIXIR - European Life-Sciences Infrastructure for Biological Information
C4G - Collaboratory for Geosciences	EPOS ERIC - European Plate Observing System
Coastnet - Portuguese Coastal Monitoring Network	ETN - European Tracking Network

CONGENTO - Consortium for Genetically tractable Organisms	INFRAFRONTIER - Infrastructure for Phenotyping and Archiving of Model Mammalian Genomes
CryoEM-PT - National Advanced Electron Microscopy Network for Health and Life Sciences	EuroBioImaging ERIC - European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences
DataLab - Social Sciences DataLab	SHARE ERIC - Survey of Health, Ageing and Retirement in Europe
EMBRC.PT - European Marine Biological Resource Centre - Portugal	EMBRC ERIC - European Marine Biological Resource Centre
EMSO-PT - European Multidisciplinary Seafloor and Water Column Observatory Portugal	EMSO ERIC - European Multidisciplinary Seafloor and Water Column Observatory
ENGAGE SKA - ENAbling Green E-science for Square Kilometer Array	SKA - Square Kilometer Array
E-RIHS.PT - Portuguese Research Infrastructure on Heritage Science	E-RIHS - European Research Infrastructure for Heritage Science
ESTHER - European Shock Tube for High-Enthalpy Research	ESA - European Space Agency
FOODCHAIN-PT - International Food Chain Alliance – Portugal	Fraunhofer Food Chain Management Alliance
FhP - AWAM - Fraunhofer Portugal Research Center for Agriculture and Water Management	Fraunhofer Association
MIA-PORTUGAL - Multidisciplinary Institute of Ageing	JPND
INCD - Portuguese National Distributed Computing Infrastructure	EGI - Advanced Computing for Research
INIESC - National Research Infrastructure in Solar Energy Concentration	EU-SOLARIS - European Solar Thermal Research Infrastructure for Concentrated Solar Power

PASSDA - Production and Archive of Social Science Data	ESS ERIC - European Social Survey, CESSDA ERIC - Consortium of European Social Science Data Archives
PORBIOTA - Portuguese E-Infrastructure for Information and Research on Biodiversity	LifeWatch ERIC - e-Infrastructure for Biodiversity and Ecosystem Research, ICOS ERIC - Integrated Carbon Observation System, eLTER - Long-Term Ecosystem Research in Europe
Portugal Space - Portuguese Space Agency	ESA - European Space Agency
PORTULAN CLARIN - Research Infrastructure for the Science and Technology of Language	CLARIN ERIC - Common Language Resources and Technology Infrastructure
PPBI - Portuguese Platform of BioImaging	EuroBioImaging ERIC - European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences
PRISC - Portuguese Research Infrastructure for Scientific Collections	DiSSCo - Distributed System of Scientific Collections
PtCRIN - Portuguese Clinical Research Infrastructure Network	ECRIN ERIC - European Clinical Research Infrastructure Network
Pt-mBRCN/MIRRI-PT - Portuguese microBiological Resources Center Network / Microbial Resource Research Infrastructure – Portugal	MIRRI - Microbial Resource Research Infrastructure
PTNMR - Portuguese Nuclear Magnetic Resonance Network	INSTRUCT ERIC
PT-OPENSCREEN - National Infrastructure for Chemical Biology and Genetics	EU-OPENSCREEN
RCTS - Science, Technology and Society Network	GÉANT
RNCA - National Advanced Computing Network	EuroHPC - European High-Performance Computing Joint Undertaking, RICA - Iberian Network of Advanced Computing

RNCCC - National Network of Comprehensive Cancer Centres	Cancer Core Europe
RNEM - Portuguese Mass Spectrometry Network	INSTRUCT ERIC - Structural Biology
ROSSIO - Social Sciences, Arts and Humanities	DARIAH ERIC - Digital Research Infrastructure for the Arts and Humanities
TEC4SEA - Modular Platform for Research, Test and Validation of Technologies supporting a Sustainable Blue Economy	Euro-Argo ERIC - European Research Infrastructure Consortium for Observing the Ocean
UC-LCA - Laboratory for Advanced Computing	PRACE - Partnership for Advanced Computing in Europe
Windscanner.PT - Portuguese Windscanner Facility	Windscanner.EU - The European Windscanner Facility

Figure 3 - Portuguese Research Infrastructures correlated to European Research Infrastructures.

1.5 European Open Science Cloud Awareness

In order to evaluate the awareness of the European initiative, a set of questions was addressed to the survey participants.

The research infrastructures and e-infrastructures were asked, based on everything they know about EOSC, how familiar they are with the initiative. Sixteen respondents referred that they are familiar with EOSC, and four are very familiar. On the other hand, thirteen participants are not very familiar and four are not familiar at all with the initiative.

	Percentage
Very familiar	10,81%
Familiar	43,24%
Not very familiar	35,14%
Not familiar at all	10,81%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=37.

Considering everything you know about EOSC, how familiar are you with the initiative?
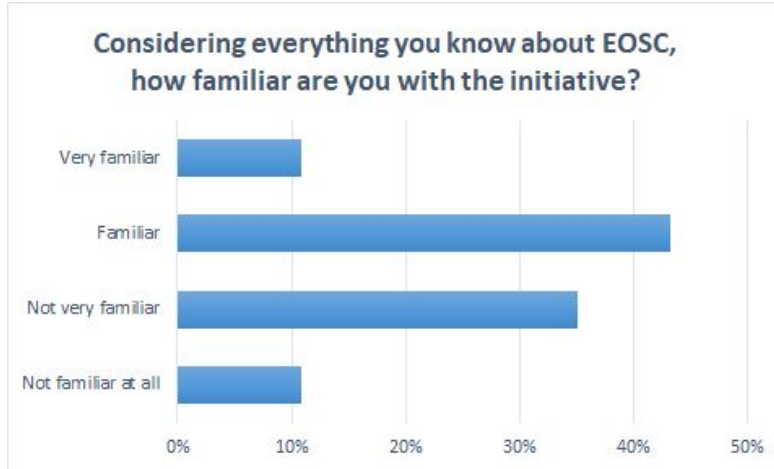
The participants of the survey were also inquired on how EOSC does or will affect their organisation and/or their strategic plans. Sixteen infrastructures expect that somewhat EOSC does or will affect them, and five infrastructures are certain that the initiative is affecting or will affect them. In opposition, nine organisations consider that EOSC will not affect them very much and one organisation even considers it will not be impacted at all. Finally, two organisations were not able to evaluate how EOSC will affect them. The information is presented below:

	Percentage
Very much	15,15%
Somewhat	48,48%
Not very much	27,27%
Not at all	3,04%
Don't know	6,06%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=33 (for this purpose were excluded the 4 organisations that stated that are not familiar at all with EOSC).

How does or will EOSC affect your infrastructure and/or your strategic plans?
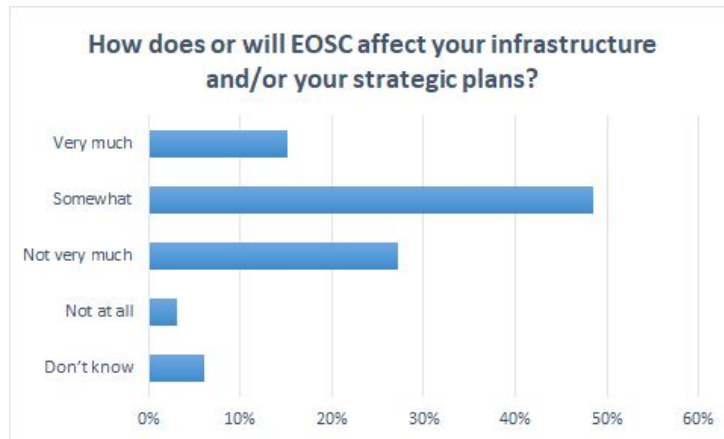
The infrastructures were also asked if they expect to benefit from the implementation of EOSC. The majority of respondents, approximately 67%, expect to benefit somewhat on the initiative, while 21% have a higher expectation.

	Percentage
Very much	21,21%
Somewhat	66,67%
Not very much	6,06%
Not at all	0,00%
Don't know	6,06%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=33 (for this purpose were excluded the 4 organisations that stated that are not familiar at all with EOSC).

Will your infrastructure benefit from the implementation of EOSC?

According to the survey data, only six of the survey participants are already contributing to the EOSC initiative. The information is the following:

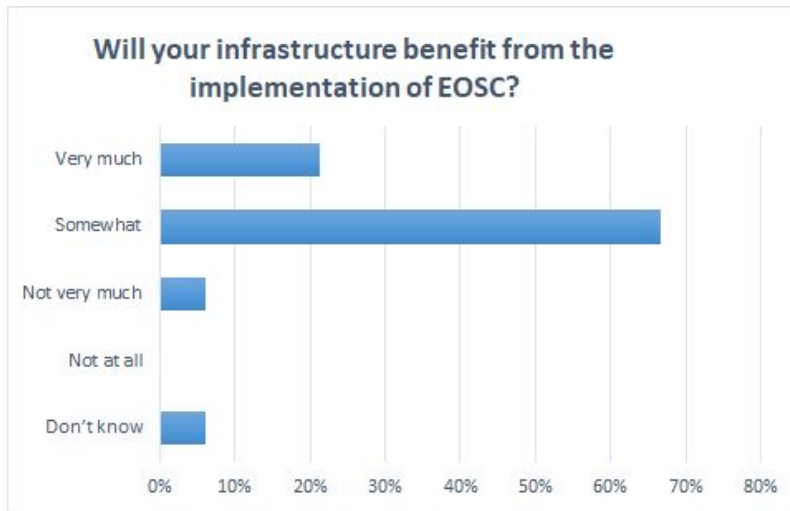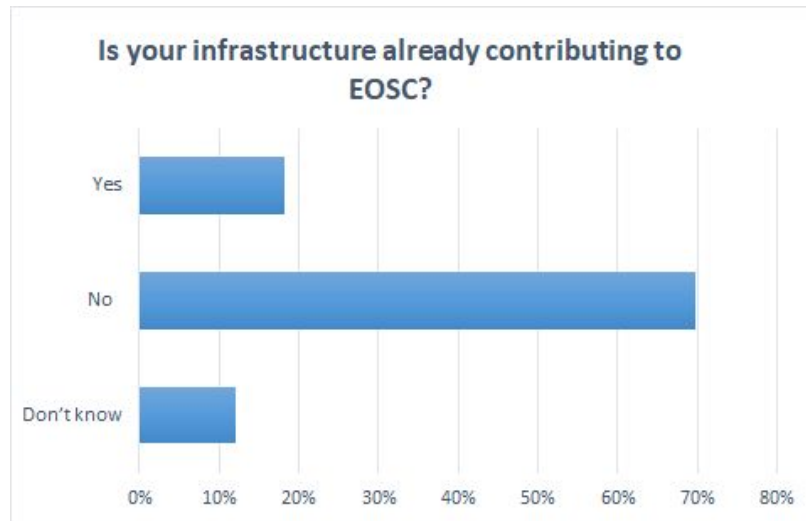|	Percentage
Yes	18,18%
No	69,70%
Don't know	12,12%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=33 (for this purpose were excluded the 4 organisations that stated that are not familiar at all with EOSC).

Is your infrastructure already contributing to EOSC?

When asked in what way is their infrastructure supporting EOSC, the statements were as follows:

- *"...acting as the network provider for the research and education community...also includes projects related to open science, namely open access to publications (nature) and research data (starting)."*

- *"...National Expert to the Executive Board Skills and training WG."*

- *"Participating in EOSC related projects EOSC-hub, EOSC-synergy. Participating in work groups. Integrating thematic services and supporting them in EOSC."*

- *"Demonstrator project of EOSC-Life."*

- *"Networking and Training Processing and analysis."*

The organisations that are not contributing to EOSC were asked how likely they will contribute to the initiative. The majority of the organisations, around 63%, consider that will likely contribute to EOSC and 11% believe they will very likely contribute to it. On the opposite, approximately 19% of the infrastructures consider that will not very likely contribute to the initiative. The information is the following:

	Percentage
Very likely	11,11%
Likely	62,96%
Not very likely	18,53%
Not likely at all	0,00%
Don't know	3,70%
No answer	3,70%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=27 (for this purpose were excluded the 4 orga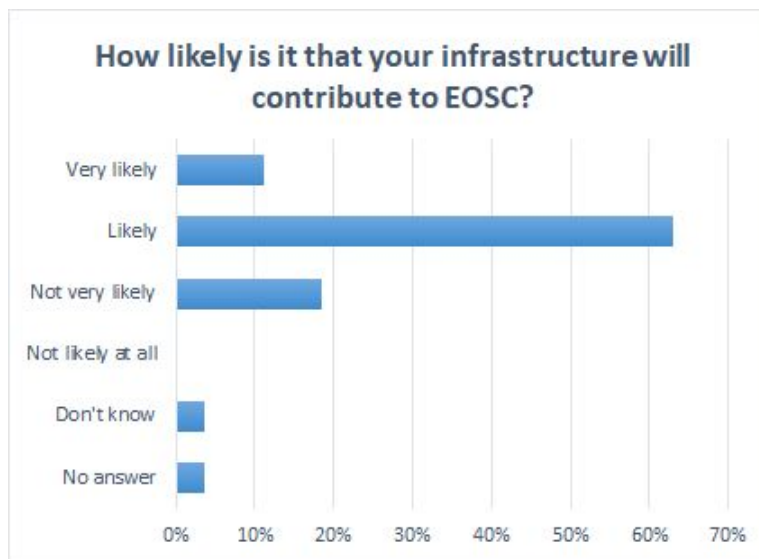nisations that stated that are not familiar at all with EOSC, and the 6 organisations that stated that are already contributing to EOSC).

When asked how beneficial is or will be contributing to EOSC, approximately 61% of the infrastructures stated that it will be somewhat beneficial, while 24% consider it very beneficial. The information is as follows:

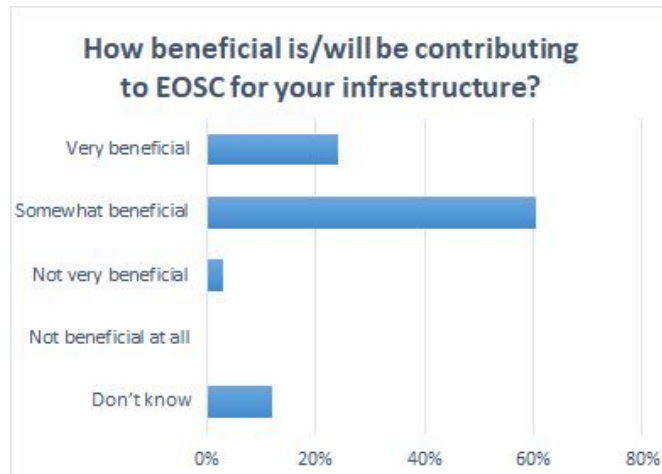|	Percentage
Very beneficial	24,24%
Somewhat beneficial	60,61%
Not very beneficial	3,03%
Not beneficial at all	0,00%
Don't know	12,12%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=33 (for this purpose were excluded the 4 organisations that stated that are not familiar at all with EOSC).

The organisations were inquired on what they expect from EOSC. Some of their statements are presented below:

- *"From the practical point of view the following: definition of the architecture, standard and guidelines, set up of the minimum viable EOSC (with CORE services), definition of governance, sustainability model."*

- *"More users - benchmarking with other similar infrastructures - financial support, at least for adapting processes to EOSC requirements."*

- *"We expect EOSC will be able to provide services that support the development of local infrastructures."*

- *"It is expected that EOSC will allow for better access to research outputs and data, specifically within the contexts of: data management and preservation; publishing and archiving services; research infrastructure instruments and facilities, and specific guidelines on how to make data FAIR. EOSC might also bridge our researchers with their research interests - both in terms of data, project outputs and other experts - and, finally, augment the infrastructure capacity, allowing for more users and more demanding tasks. It is also expected that EOSC will allow new practices within our organisation services, such as: share the outputs of scientific research with a broader community; have the possibility to combine different datasets; and reuse data to allow a more efficient scientific process."*

- *"The integration and availability of our data to the scientific community."*

- *"Provision of technical support for decision makers regarding open science and the implementation mechanisms/instruments to a European (and also national) open science cloud, guidelines for the implementation at the European and national levels of the open science cloud."*

- *"Higher visibility and easier access to e-infrastructure services, thematic services and scientific data. Harmonizing policies and federating national research e-Infrastructures, scientific data and thematic services. Support for opening national services European wide. European wide environment to facilitate data storage, data movement, data archival, data processing/analysis and data reuse facilitating the creation of new added value services and derived data sets."*

- *"I envisage that we will be carrying out our bioinformatics in EOSC."*

- *"To provide a useful service by collecting data from e-infrastructures, thereby contributing to raising awareness of their services by European researchers. At least for HPC infrastructures, I do not believe EOSC should also manage their access to their services."*

- *"The reinforcement of the Open Science and Innovation from a practical way, increasing the digitalization policies."*

- *"...by federating existing infrastructures, EOSC will also give more visibility to the resources from the other members of the consortium. The resources made available on the open and free platform can also be disseminated in EOSC to be used by worldwide researchers and, in this way, contributing to open science. Since EOSC is an initiative from the European Commission, we will also be looking for further funding opportunities. Our present funding system has limitations which makes it harder and more time demanding to develop the infrastructure. Furthermore, we must also consider the opportunities that will help us have a long-term commitment and an enriched*

infrastructure. It cannot finish once the actual funding ends. We must look for other opportunities which will help us reach long-term sustainable work."

- *"Safety of stored contents - Clear framework for IP - Ease of access to contents by topic."*

- *"Foster collaboration with other EU level infrastructures; access, use and reuse research outputs and data across disciplines."*

- *"To be a truly interoperable and open platform where data can be shared and re-used by (healthcare) professionals in a thorough but simple way to allow improvement of knowledge and good practices throughout Europe."*

- *"Scientific interaction and cooperation, increasing the development of products and services."*

- *"Contributing for dissemination of the data gathered by the infrastructure; contributing for establishment of international partnerships; contributing for securing additional funding."*

- *"The data generated from our experiments will be accessible through the EOSC services and partners."*

- *"...I think that EOSC provides more meaningful and systematic use for the material and immaterial information about Portuguese scientific collections (over 6 million objects)."*

- *"Easy and centralized access to resources especially computing, data storage and data analysis, support to implement open data policy, access to open data standards, identifiers and good search tools for data and infrastructures. In a few words, increase Open Science!"*

- *"Optimize information and in some way bio resources."*

- *"Access to HTC/HPC platforms, data analytics, scientific instruments and facilities, consultancy & training."*

- *"Better networking among European Research Infrastructures. Provide and receive more research data."*

- *"Expand the reach (and utility) of the infrastructure to a wider community."*

- *"The possibility to integrate big, real world, multi-disciplinary and simulation data, ideally in real time can have strong impact."*

2 National policies and frameworks for open science support and collaboration

The Portuguese Research and Innovation (R&I) System reflects the cooperation between different stakeholders that contribute as a whole to the educational, scientific, technological and innovation sectors in Portugal.

At a first level, the <u>Portuguese Government (Council of Ministers)</u> has the responsibility in terms of policy and strategic direction for Higher Education, Research and Innovation. Additionally, it is also responsible for the implementation of European Union (EU) Structural and Investment Funds in Portugal, according to the EU guidelines.

The National Council for Science, Technology and Innovation (CNCTI)[25] advises the Government on science, technology and innovation, while the National Council on Entrepreneurship and Innovation (CNEI)[26] advises the Government on entrepreneurship.

Following this level, the governance is composed by <u>individual line Ministries</u>, headed by Ministers with specific governments.

The MCTES has the purpose to formulate, conduct, execute and evaluate the national politics for science, technology and higher education. To this end, consider scientific and technological innovation, guidelines in what concerns the digital repositories, scientific computation, diffusion of scientific and technological culture, and scientific and technological cooperation worldwide.

It is important to refer that the primary responsibility for business innovation policy lies within the Ministry of Economy, while the Ministry of Planning and Infrastructure is in charge of the European Union structural funds management.

At a third level, the governance is composed of <u>several agencies with implementation or regulatory responsibilities</u>. Some of these agencies are described below:

- FCT which mission includes the development, funding and evaluation of institutions, networks, infrastructures, scientific equipment, programs, projects and human resources in all the scientific and technological domains;

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[25] https://dre.pt/web/en/home/-/contents/122317422/details/normal
[26] https://dre.pt/pesquisa/-/search/553386/details/maximized

- The National Innovation Agency (ANI)[27] that manages the incentive programmes focused on businesses and technological interface centres. This agency aims to foster technology transfer and knowledge promotion, as well as focus on collaboration;

- The Competitiveness and Innovation Agency (IAPMEI)[28] that aims to promote innovation initiatives and boost competitiveness of Portuguese firms through financial and business support, services and training;

- The National Agency for Scientific and Technological Culture (Ciência Viva)[29] which plays a key role in the promotion of scientific and technological culture among the Portuguese population.

Lastly, the fourth level of R&I System governance includes the organizations that are dedicated to the production of knowledge, such as Universities, Polytechnics, R&D Units and Research Infrastructures. It also includes Interface Institutions that serve as a link between these entities and knowledge receptors, such as business enterprises.

2.1 Formal regulations or publicly available policies

In this section, we provide a brief overview of formal regulations and publicly available policies in Portugal.

The Portuguese Government and the MCTES have defined as a priority the commitment of science to the Principles and Practices of Open Science[30]. In fact, Open Science allows the translation of scientific knowledge to the scientific community, society and companies, making it possible to increase the recognition and the social and economic impact of science.

Open Science presents the following pillars:

- Transparency in practices, methodology, observation and data collection;
- Public availability and re-use of scientific data;
- Public access and transparency in scientific communication;
- Use of web-based tools to facilitate scientific collaboration.

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[27] https://www.ani.pt/en/

[28] https://www.iapmei.pt/SOBRE-O-IAPMEI/Missao-Visao-Valores.aspx

[29]

https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/organisation/ci%C3%AAncia-viva-national-agency-scientific-and-technological-culture

[30] https://www.ciencia-aberta.pt/home

In pursuit of this goal, the MCTES published in February 2016 the **Guiding Principles for Open Science** [31], which include:

- Open access for publications generated by public funding research;
- Open access for scientific data produced through public funding research;
- Assurance on the preservation of scientific publications and data, enabling their reuse and continued access.

In March 2016, the MCTES was mandated by the Council of Ministers to create an Inter-Ministerial Working Group (WG) with the purpose to present a strategic plan for the implementation of the **National Policy for Open Science (PNCA)** [32].

This WG included members from the national scientific and technological system, as well as of other relevant organizations.

Under the WG, there were sub-groups that conducted studies and issued recommendations, according to four important areas:

- Open Access and Open Data;
- Infrastructures and digital preservation;
- Scientific evaluation;
- Social scientific responsibility.

Please note that these recommendations were not officially adopted.

FCT has adopted an Open Access policy in line with the European Commission recommendations, and in accordance with other public R&D financing agencies from other countries. In fact, FCT encourages researchers to make data available from R&D projects that are publicly funded in appropriate Open Access databases, whenever possible.

Additionally, FCT recommends that researchers promote and participate in national and international projects that seek the most appropriate forms of data sharing in the different areas of knowledge. At the moment there is not a mandatory policy concerning research data management, only a set of recommendations. FCT is currently working on the update and broader scope of the data policy, following the recommendations from Science Europe, as well as the requirements from Horizon 2020 and Horizon Europe programmes.

In addition, a Data Strategy is being currently prepared to be implemented at a national level.

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[31] https://www.ciencia-aberta.pt/guiding-principles
[32] https://www.ciencia-aberta.pt/working-group

- **Relevant Legislation**

In the past years, important legislation has been produced in the context of innovation, science and technology, and in the democratization of access to knowledge.

In what concerns awarding grants for science, technology and innovation, as well as to implement the attributed funds, several simplification measures were defined through **Decree-Law n. 60/2018**[33], namely:

- Creation of a unique digital identifier named "Ciência ID", which allows the aggregation and reuse of information, ensuring simplified and integrated user management in the context of science, technology and national innovation;

- Inclusion of a science curriculum management system named "**CIÊNCIA**VITAE", that constitutes the central element for managing information on scientific and technological activity by aggregating in a single system the information spread across multiple platforms;

- Maintenance of a national database on public funding for R&D activities, publicly available, "SciPROJ";

- Review of information systems and document management of funding entities and other public entities, and promotion of interoperability between computer systems.

A monitoring group was created in order to pursue these planned measures, making available a bi-annual report.

In May of 2019, **Decree-Law n. 63/2019**[34] defined a set of rules to which scientific research and technological development institutions should obey. The juridical regimen associated to these entities was reviewed in order to reinforce the following areas:

- Institutional context, namely the scope, organization, diversification and connection with the territory of the entities of the national science and technology system;

- Human capital, promoting its reinforcement and qualification and striving for adequate conditions for the development of scientific employment;

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[33] https://dre.pt/web/en/home/-/contents/115886130/details/normal

[34] https://dre.pt/web/en/home/-/contents/122317422/details/normal

- Social, cultural, institutional and scientific responsibility related to R&D activities and the promotion of scientific and technological culture;

- Internationalization, including the need to strengthen international scientific and technological cooperation, and also the participation of national R&D institutions in international organizations;

- Role of the Government in the areas of evaluation and funding of national scientific and technological system, and observation and recording of science and technology data;

- Adoption of open practices and processes for creating, sharing and use of scientific knowledge, according to the best international practices.

More recently, **Law n. 66/2019**[35] authorized the Government to set up a system for collecting, recording and analysing data on science and technology, concerning human resources, R&D institutions, scientific activity, projects and funding. The **Decree-Law n. 156/2019**[36] complements the previous legislation, once it regulates the creation and maintenance of such a system.

- **Other Initiatives**

In 2017 it was established the National Digital Competences Initiative e.2030, also known as **Portugal INCoDe.2030**[37]. This initiative seeks to stimulate and ensure the development of digital skills, the generalization of digital technology access to the community and produce new knowledge through international cooperation projects.

To address the challenges, the initiative's measures and goals were structured according to five main action lines: inclusion, education, qualification, specialization and research.

In what concerns research, the initiative aims to create and provide the necessary conditions for the production of new knowledge and participation in international R&D networks and projects.

With the objective of turning the e-infrastructures transversal to all scientific areas, the European Commission has proposed, under EOSC's initiative, a virtual environment for European researchers to store, manage, analyse and reuse data.

There has been an effort to develop national counterparts for European e-infrastructures.

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[35] https://dre.pt/web/en/home/-/contents/122349220/details/normal

[36] https://dre.pt/web/en/home/-/contents/125560575/details/normal

[37] https://www.incode2030.gov.pt/en

2.2 Strategies and policies for funding infrastructure services and resources

As previously mentioned, FCT is the Portuguese national funding agency for all scientific areas of science and technology, promoting excellence, innovation and international competitiveness across all areas. This entity supports research infrastructures of strategic interest that sustain scientific and technological advances and strengthen the capacity of the R&D community in Portugal.

FCT supports the scientific community in Portugal through a range of funding programs, tailored for individual scientists, research teams or R&D centres. Through its funding programs, FCT supports graduate education, research and development, establishment and access to research infrastructures, networking and international collaborations, conferences and meetings, science communication and interactions with industry.

ANI is also a national funding agency, which aims to develop actions to support technological and business innovation in Portugal, contributing to the consolidation of the National Innovation System (NIS) and to strengthening the competitiveness of the national economy in global markets. ANI is responsible for pursuing the guidelines for a technological and business innovation strategy for Portugal, from 2018 to 2030. The pursuit of ANI's mission is articulated with other public policy objectives such as priorities for the next cycle of Structural Funds, the National Investment Programme 2020-2030, the National Reform Programme and the National Programme for Spatial Planning Policy, as well as the priorities and objectives associated with Portugal's participation in R&D support programmes within the European framework.

FCT is the national contact point (NCP) of the framework programme for research and innovation Horizon 2020. ANI contributes to the promotion and support of national, scientific and business communities' participation, within this framework programme. In what concerns Horizon Europe, FCT will remain as a NCP and ANI will help to coordinate some of its pillars.

2.3 Present status with regard to Commission Recommendation (EU) 2018/790 on access to and preservation of scientific information (NI4OS 14-mc)

According to the **Commission Recommendation (EU) 2018/790**, the Member States should set and implement clear policies on:

- The dissemination of and open access to scientific publications resulting from publicly funded research. In Portugal, FCT|FCCN operates RCAAP, the national network of institutional repositories.

- The management of research data resulting from publicly funded research, including open access. FCT is starting to plan a national initiative on research data.

- Reinforcing the preservation and re-use of scientific information (publications, data sets and other research outputs). About half of the national repositories went through an informal certification of ISO 16363. In addition, the national consortium for scientific publications has an agreement with the Portico initiative.

- Infrastructures for open science. FCT|FCCN will implement and develop research data infrastructures and services. Communication, dissemination and training for the community are also contemplated.

- Ensuring synergies among national infrastructures, with the EOSC and other global initiatives. Several Portuguese institutions are involved and align with EOSC and other global initiatives.

- Necessary skills and competences of researchers and personnel of academic institutions regarding scientific information. Presently, a training network of people handles open access. A similar process is planned for research data.

- Adjusting, with regards to scientific information, the recruitment and career evaluation system for researchers, the evaluation system for awarding research grants to researchers, and the evaluation systems for research performing institutions. In Portugal, incentives and rewards are still in a stage of awareness creation.

According to the conducted survey, both research infrastructures and e-infrastructures were inquired on the status with regard to Commission Recommendation (EU) 2018/790. Please find below some of the obtained answers:

- *"In a general way, the infrastructure acts under the principles of Open Science and has already implemented operational processes that assure the access, preservation and reuse of the research data produced by itself and by others as well."*

- *"Totally aligned. The infrastructure has an open access policy. Strategies for access, data use and data management with access to instrumental infrastructures are defined around four different models: free access to external national researchers, free access of European external researchers, work for paying clients, and access between partners. These strategies are planned and are likely to be implemented at European level in a near future. Information on access and data use is available on the Infrastructure's website. Competitive calls for access are published. The goal is to create a global database where all data will be stored and managed…"*

- *"We employ the FAIR principles and all our data becomes freely available soon after is produced or published."*

- *"Our Infrastructure privileges solutions which go along with the good international practices, mainly, the FAIR Principles and the ones defined by EOSC. The resources from the consortium members, as the outputs from academic research, will be available on an open and free platform to academics and to the common citizen. Those digital objects are constantly increasing – scientific production gets intensified and, at the same time, institutions digitalize more and more physical resources they guard. Our infrastructure's alignment with the European guidelines in terms of interoperability, contribute to the universality of access and use of information, also assuring data preservation. The digital objects, scientific and non-scientific, made available on our platform can be used and reused by everyone, from different academic degrees and with different goals on its use. In this way, our infrastructure will contribute to generate knowledge and an informed society. It will help develop economic growth and innovation, by stimulating tourism, education, stakeholders, among others. Knowledge will be shared, changing to an open, efficient and more reactive science…"*

- *"We are developing our data management policy based on the Recommendation."*

A small number of infrastructures mentioned that they are not following the recommendation.

3 EOSC compliant resources

3.1 Characteristics of services/resources

According to the conducted survey, thirty-two of the thirty-seven infrastructures are defined as research infrastructures. These entities were inquired on the type of services provided to the research community, based on the European's Commission categorization[38]. The information is as follows:

	Percentage
We offer knowledge-based resources such as collections, archives or research data	43,75%
We offer data and computing systems, and communication networks	18,75%
We offer major scientific equipment or sets of instruments	75,00%
We offer other research and innovation infrastructure of a unique nature essential to achieving excellence in research and innovation	37,50%
Other	21,88%
No, none of the list	3,13%

Note: question was asked to **Research Infrastructures**; multiple choice question; N=32.

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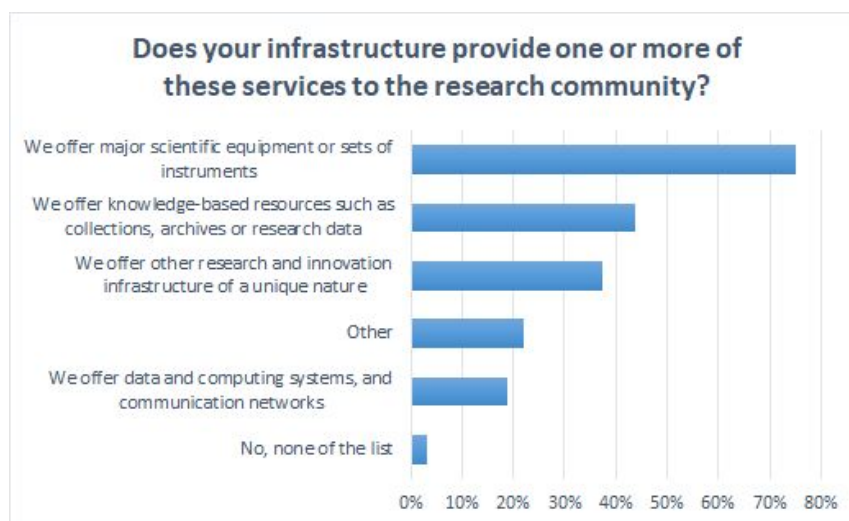
[38] https://ec.europa.eu/info/research-and-innovation/strategy/european-research-infrastructures_en

The highest percentage corresponds to services related to major scientific equipment, followed by knowledge-based resources such as collections, archives or research data, and other research and innovation infrastructure of a unique nature.

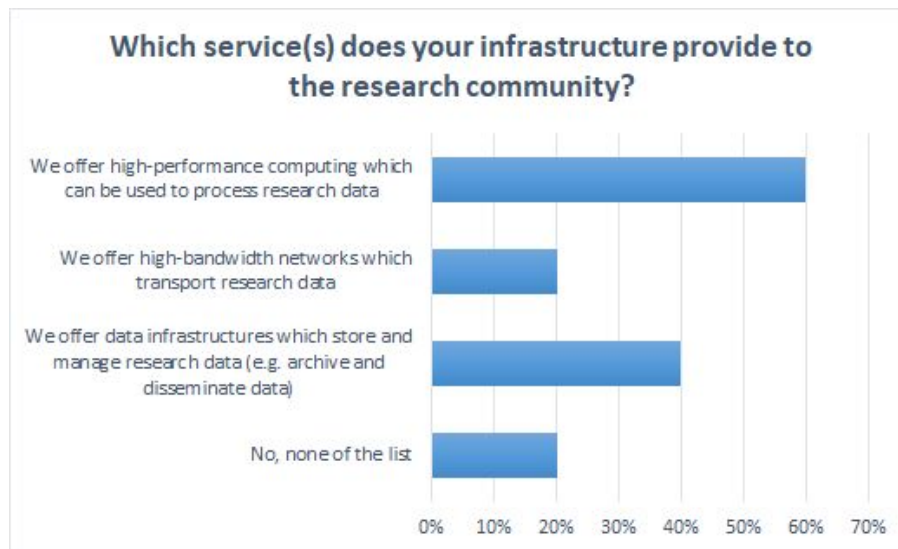Some research infrastructures provide different types of services, such as:

- Marine biological resources;
- Smart grids;
- Test solar components;
- Services in GMOs for biomedical research (generation, maintenance, cryopreservation, etc.);
- Promoting space applications;
- Medical physics and clinical data.

From the total survey respondents, five were classified as e-infrastructures in the first Portuguese National Roadmap. These organisations were questioned on the type of services provided considering the EOSC definition for this categorization[39]. The answers obtained are as follows:

	Percentage
We offer data infrastructures which store and manage research data (e.g. archive and disseminate data)	40,00%
We offer high-bandwidth networks which transport research data	20,00%
We offer high-performance computing which can be used to process research data	60,00%
No, none of the list	20,00%

Note: question was asked to **e-Infrastructures**; multiple choice question; N=5.

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[39] https://ec.europa.eu/digital-single-market/en/e-infrastructures

Which service(s) does your infrastructure provide to the research community?

One of the organisations did not select any of the listed services. It corresponds to a thematic infrastructure, and therefore does not cover all general domains. Please note that in accordance with the recently updated Portuguese Roadmap of Research Infrastructures, this specific organisation was classified under "Health and Food" domain.

The other four e-Infrastructures included in the National Roadmap, were already mentioned in chapter 1, and are as follows:

- RCTS - Science, Technology and Society Network, which delivers high performance networking services, as well as research data services;

- RNCA - National Network of Advanced Computing, that provides high performance computing services to the research, technology and innovation communities;

- INCD - National Distributed Computing Infrastructure, which delivers computing and storage services to the scientific and academic community;

- UC-LCA - Laboratory for Advanced Computing, that offers high performance computing resources and services.

- **Services according to domain**

Both research infrastructures and e-infrastructures were asked to describe their services in accordance to their domain. The higher percentage of services is related to engineering and technology, followed by natural sciences, medical and health sciences, agricultural sciences, social sciences and humanities.

	Percentage
Engineering and Technology	59,46%
Natural Sciences	56,76%
Medical and Health Sciences	45,95%
Agricultural Sciences	37,84%
Social Sciences	21,62%
Humanities	16,22%
Other	13,51%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; multiple choice question; N=37.
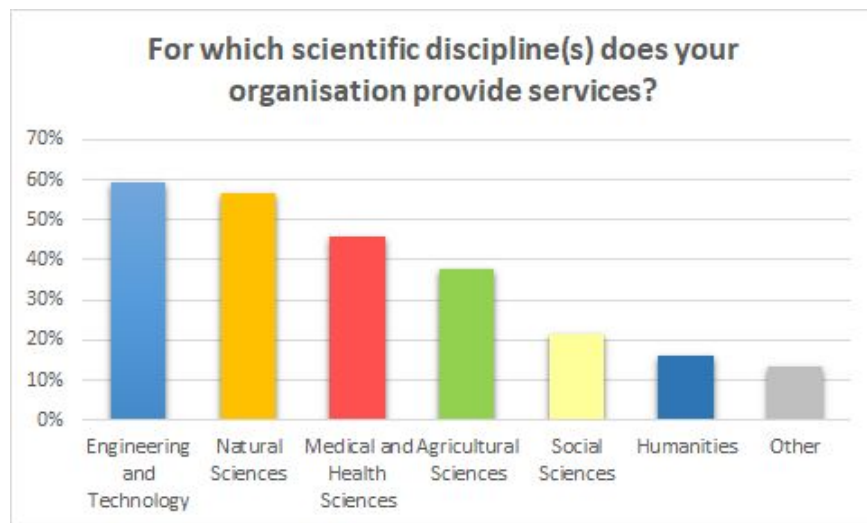
There are specific domains that were classified as "other" and include:
- Oceans data products;
- Circular economy.

- **Services to become part of EOSC**

The research infrastructures and e-infrastructures were required to indicate one or more of their services that could become part of EOSC. Below are some of the statements:

- *"At the moment the services most likely of being used are those which provide search and discovery of social science data, process sensitive data and contribute to making FAIR data."*

- *"Our infrastructure provides free of charge data access to the scientific community, upon registration of users. These data cannot be used for any purpose other than scientific research and, as the vast majority of our infrastructure's data is not research outputs or metadata, the structure may find some difficulties being embedded into EOSC Service Catalogue."*

- *"We do not currently have services that could be included."*

- *"Electron microscopy and XPS/FTIR analysis."*

- *"Ready for BioData Management? - Capacity building program for Life Sciences";*

- *"Technical and research and development services in the area of whole feed and livestock productive chains and their integration in agricultural production systems. Development of processes to improve resources' management and consequently reduce food waste and greenhouse gas emissions."*

- *"Sequencing data."*

- *"The database on animal models that we are currently implementing can be a useful tool for the European research community. We can also take advantage of the EOSC to catalog our services."*

- *"Processing of big amounts of EO data, CREODIAS platform cloud infrastructure adapted Cloud Ferro Data related Services - EO Finder Cloudferro Data related Services - EO browser."*

- *"TERM RES-Hub - Tissue Engineering and Regenerative Medicine Infrastructure."*

- *"Our infrastructure is mainly a provider of access to scientific equipment so at the moment with the EOSC organisation I find it difficult to offer our services to EOSC."*

- *"High performance networking services, aai services, collaboration services, open access, research data services."*

- *"Big data convergency with HPC - Eudat suite."*

- **Expected innovations of services in next five years**

The research infrastructures and e-infrastructures were inquired on the expected innovations of services in the next five years. Some of the statements are as follows:

- *"The main aim is to become a trustworthy infrastructure. That means to make further progress in areas such as repository certification, metadata standards or Fair data and define clear policies concerning data management and preservation."*

- *"In the near future, our infrastructure aims to be a robust and consolidated physical infrastructure, scaling up its capacity and effectiveness by allowing data access, archiving and sharing. In that sense, the next steps for innovation within our research infrastructure instruments and facilities will be: increase the number of subscribed databases relevant to scientific community; extend data access services to a broader community of students, faculty and researchers; extend storage services and computational capacity to more researchers nationally and internationally; implement new technologies to provide cutting edge tools for researchers to use in their work, such as new software and cloud services."*

- *"Providing deep sea data (physical and chemical) part of EU directive, EMSO."*

- *"Testing and validation of concepts and prototypes."*

- *"Training, technology transfer in micro and nanofabrication processes."*

- *"We aim to implement a biomedical and clinical research network supported in the institutions that are part of the infrastructure to promote clinical and translational research."*

- *"Have a set of robotic and sensor equipment available for multidisciplinary research, including neuroscience and robotics."*

- *"Research Infrastructure for Telecommunications beyond 5G."*

- *"Multidisciplinary analysis framework: integrating EEG, Virtual Reality and physical computing sensors. This will work locally and will have data cloud storage and processing…"*

- *"Earth Observation Data…"*

- *"Novel cancer therapy and associated research."*

- *"A national repository for human genomic data - Local EGA."*

- **Funding of research infrastructures (budgets at the receiving end): including "revenues other than funding"**

Research infrastructures and e-infrastructures are funded in Portugal through different means. Within the scope of the survey, the infrastructures were asked on the source of funding to their operation.

According to the obtained information, there is usually more than one type of funding. The main sources of funding are related to European funds, funding bodies, the State, universities and research institutions.

	Percentage
European funds	67,57%
Funding agencies/ funding bodies	64,86%
State/ ministry	54,05%
Research institution(s)	43,24%
University	43,24%
Industry/ small and medium-sized enterprises (SMEs)	37,84%
Region/ town	32,43%
Research communities	13,51%
Other	5,41%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; multiple choice question; N=37.

Who recurrently provides funding to your infrastructure?
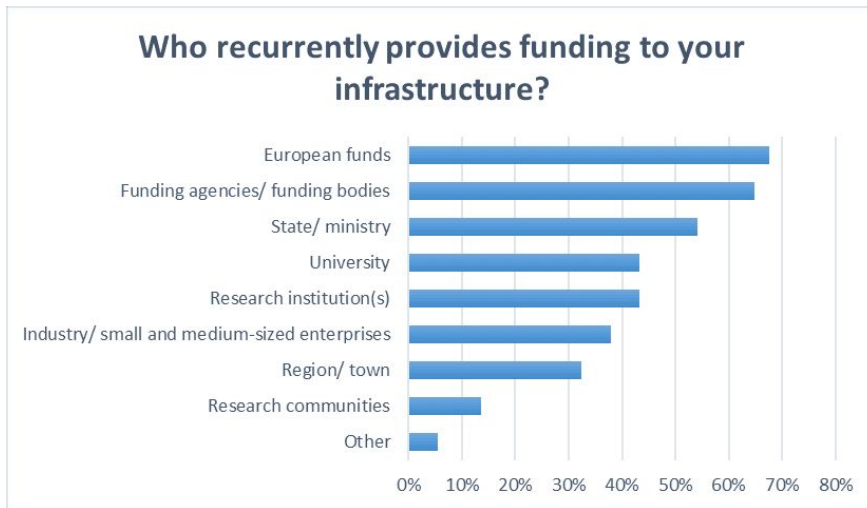
Some of the infrastructures generate a portion of their own funding. We asked the infrastructures if they also acquire their own revenues other than funding. The answers are as follows:

	Percentage
Yes	54,05%
No	45,95%
Don't know	0,00%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=37.

Does your infrastructure acquire own revenues other than funding?

In accordance with the obtained information, twenty out of thirty-seven infrastructures acquire their own revenues. The main sources are related to consultancy and training, other services and hosting.

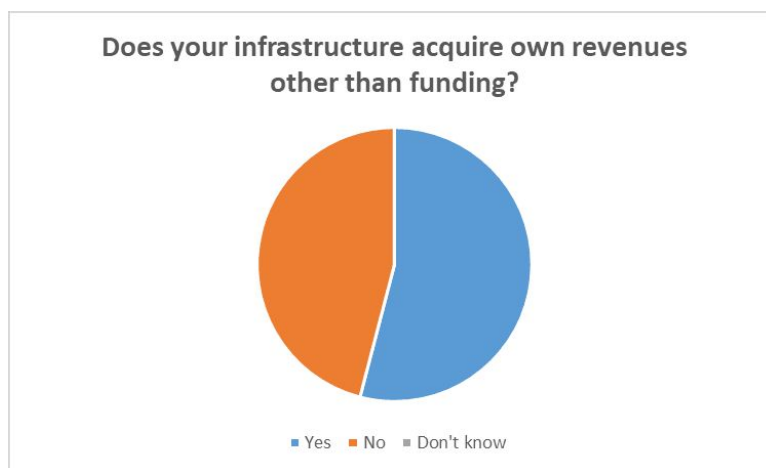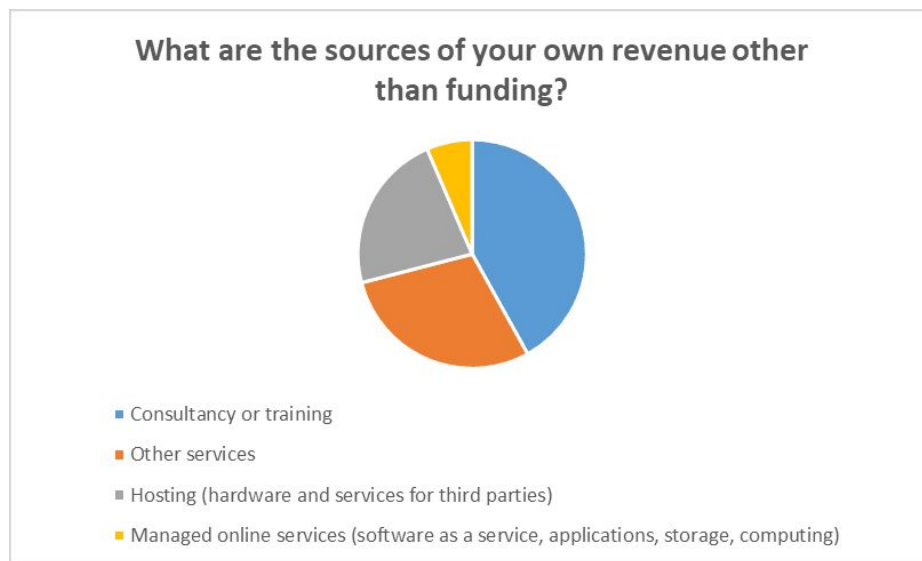|	Percentage
Consultancy or training	65,00%
Other services	45,00%
Hosting (hardware and services for third parties)	35,00%
Managed online services (software as a service, applications, storage, computing)	10,00%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; multiple choice question; N=20 (answered yes to the previous question).

According to the answers obtained, the "other services" are mainly related to the specificity of the infrastructures' services and include:

- Characterization services;
- Users fees;
- Medical services;
- Analytical services;
- Prototype constructions;

- Networking and collaboration services.

- **Role and type of Service Level Targets and potential issues/barriers**

The survey addressed specifically the e-infrastructures on Service Level Targets (SLTs) offering. According to the responses, 50% of the e-infrastructures provide SLTs, while the other 50% foresee to provide these services in the future.

	Percentage
Yes, for all services	0,00%
Yes, for some services	50,00%
No, but foreseen in the near future	50,00%
No, not foreseen in the near future	0,00%
Not applicable	0,00%

Note: question was asked to **e-Infrastructures**; N=4.

The e-infrastructures were asked if they are participating in a transnational infrastructure or federation that offers SLTs or similar contracts that include them. Three of the four organisations responded affirmatively:

	Percentage
Yes	75,00%
No	25,00%
Don't know	0,00%
No answer	0,00%

Note: question was asked to **e-Infrastructures**; N=4.

When asked if they encountered issues or barriers to establish SLTs with a community, three of the four e-infrastructures stated that they did not. One of the organisations responded as follows:

- *"Offering a service level target is only valuable if a penalty exists for breach of service level targets. However academic/scientific organizations cannot incur in such costs or legal provisions. Generally speaking those targets are implemented as intended targets and most services are delivered as best effort."*

	Percentage
Yes	25,00%
No	75,00%
Don't know	0,00%
Not applicable	0,00%

Note: question was asked to **e-Infrastructures**; N=4.

In terms of type of SLTs that e-infrastructures are offering or will offer in the future, two responded "several predefined types", one responded "custom made types" and the other one selected the option "one fits all agreement". The information is as follows:

	Percentage
Several predefined types	50,00%
Custom made type	25,00%
One-fits-all	25,00%
Other	0,00%
Not applicable	0,00%

Note: question was asked to **e-Infrastructures**; N=4.

3.2 Data services

3.2.1 Data management, curation and (long-term) preservation

Research infrastructures in Portugal deal with different data and therefore there are also different data management processes.

- **Documentation and metadata standards (including provenance, metadata languages)**

Both research infrastructures and e-infrastructures were inquired if they do implement measures for ensuring documentation about the origin and the changes made in data (i.e. data provenance).

According to the survey, approximately 46% of the organisations referred that this is not applicable to their specific situation, around 24% do implement measures and 30% do not.

	Percentage
Yes	24,32%
No	29,73%
Not applicable	45,95%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=37.
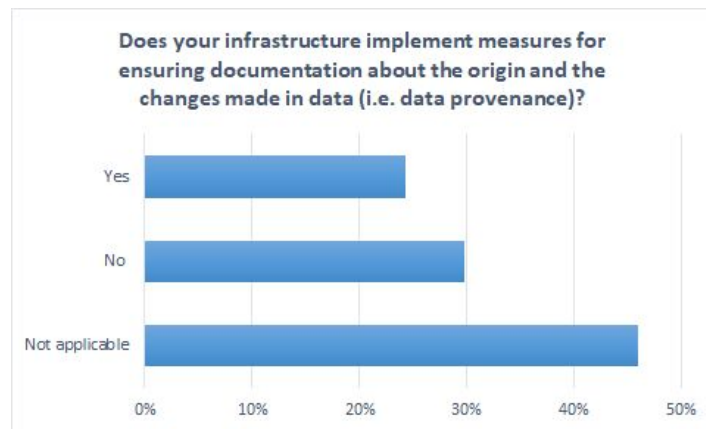
In order to ensure documentation about the origin and the changes made in data (i.e. data provenance), the most common measure implemented is the version control, followed by file integrity checks.

|	Percentage
Version control	88,88%
File integrity checks (e.g. checksums, fixity checks)	55,55%
Other	11,11%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; multiple choice question; N=9 (infrastructures that responded "Yes" to the previous question).

Which measures for ensuring documentation about the origin and the changes made in data does your infrastructure implement?
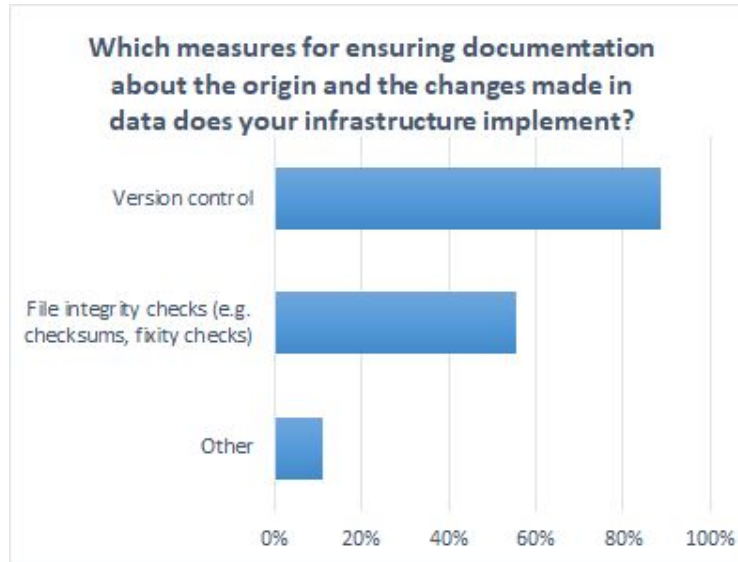
Our survey shows that metadata is provided mainly in English and Portuguese. In fact, more than half of the participants provide 100% of the metadata in English and approximately 21% of participants provide all the metadata in Portuguese. Please find the information below:

	0%	1-25%	26-50%	51-75%	76-99%	100%
Portuguese	47,37%	10,53%	10,53%	5,26%	5,26%	21,05%
English	0,00%	15,79%	10,53%	0,00%	21,05%	52,63%
Spanish	94,74%	5,26%	0,00%	0,00%	0,00%	0,00%
Dutch	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%
French	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%
German	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Italian	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; array question; N=19 (infrastructures for which it applies metadata).

In which language(s) does your organisation provide metadata?
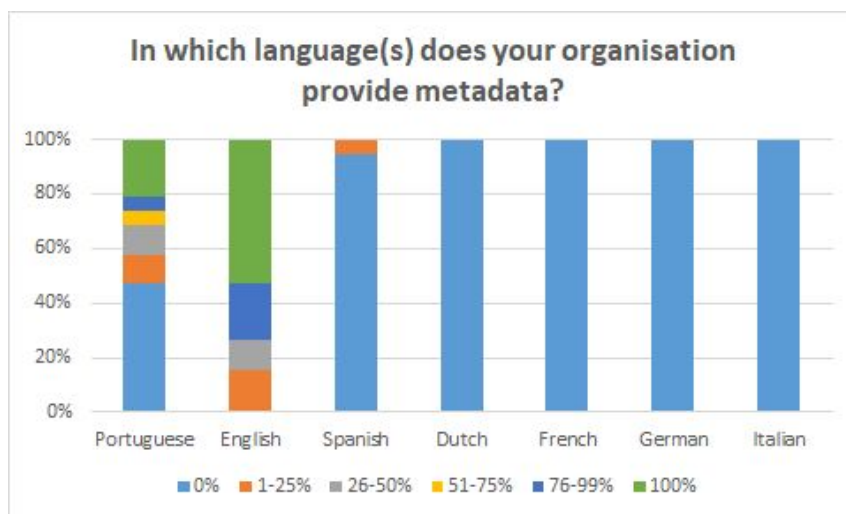
- **Regulations and policies**

As far as the adopted policies on open science and FAIR data are concerned, Portugal is currently in the planning phase.

There is a national policy in place for publications, which includes an open access approach. In terms of data, Portugal is currently in the planning phase for a policy on data and services. Also, it is planned to include and refer to the EOSC initiative in the policies.

Both research and e-infrastructures were asked if they provide services on support for data management plans, advice on data management or legal issues. The majority of the infrastructures do not provide this type of services. In fact, only approximately 22% of the organizations provide support for data management plans, 38% provide advice on data management and 22% on legal issues.

	Yes	No	No answer
Support for data management plans	21,62%	72,97%	5,41%
Advice on data management	37,84%	56,75%	5,41%
Support concerning legal issues	21,62%	72,97%	5,41%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; array question; N=37.

Does your infrastructure provide the following services?
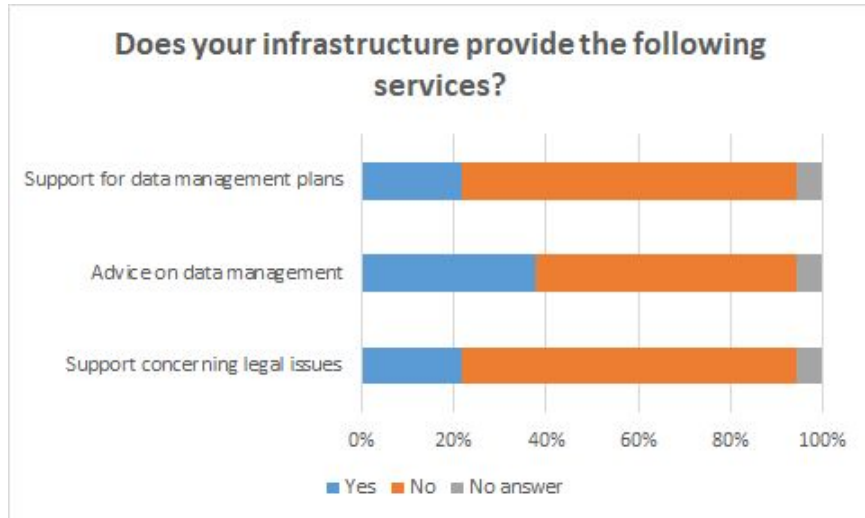
- **Standardized/controlled vocabularies for metadata**

The use of standardized/controlled vocabularies for metadata is only applied by seven of the inquired infrastructures. The most recurrent vocabularies are: COAR types, DDI Controlled Vocabularies, MIxS, Dublin Core, Crop Ontology, CESSDA Topic Classification, MIMMARKS, SKOS, FOAF, CIDOC-CRM, Bibliographic Ontology and Europeana Data Model.

	Percentage
Yes	18,92%
No	37,84%
Not applicable	43,24%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=37.

Does your infrastructure use standardized/controlled vocabularies for metadata?
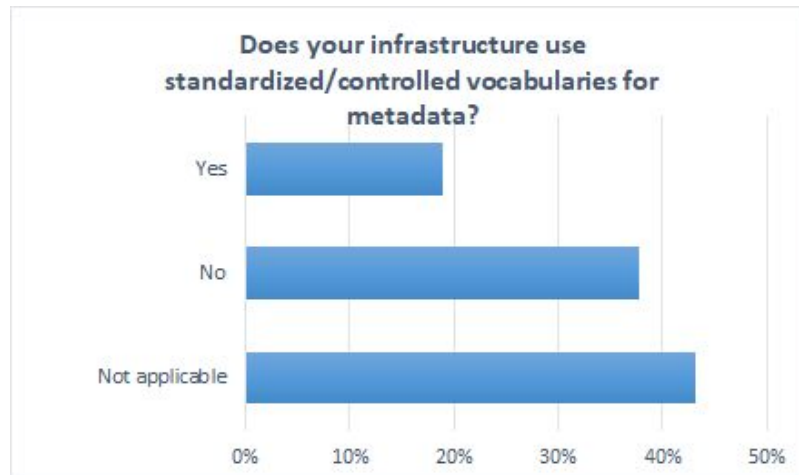
- **Certified repositories**

In accordance with the survey, the participants were asked whether they completed any certifications or audits relevant for repositories, between 2015–2019. The results show that only very few respondents have the certification or are preparing certification processes.

	Yes	No, but in preparation	No
Core Trust Seal (CTS)	0,00%	0,00%	100,00%
Data Seal of Approval (DSA)	0,00%	10,00%	90,00%
World Data System (WDS)	0,00%	10,00%	90,00%
ISO 16363 Certification	5,00%	10,00%	85,00%
Nestor Seal	0,00%	0,00%	100,00%
Digital Repository Audit Method Based on Risk Assessment (DRAMBORA)	0,00%	5,00%	95,00%
Trustworthy Repositories Audit & Certification (TRAC)	0,00%	5,00%	95,00%
Other	15,00%	0,00%	85,00%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; array question; N=20 (applicable situation).

Other repositories certifications include:

- ISO 9001;
- FitSM.

- **Curation process**

An important part of FAIR services is a curation of the contents of repositories. Our survey shows that approximately 55% of the participants do not perform curation of the contents, distributing the contents as deposited. Around 26% of the participants perform basic curation, while 17% perform enhanced curation. On the other hand, 10% of respondents stated they are doing data level curation, including migration of data formats and advanced care of deposited data.

	Percentage
We distribute the content as deposited	55,17%
We perform basic curation (e.g. brief checking, addition of basic metadata or documentation)	27,59%
We perform enhanced curation (e.g. conversion to new formats, enhancement of documentation)	17,24%
We perform data-level curation (all changes made above and additional editing of deposited data for accuracy)	10,34%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; multiple choice question; N=29 (infrastructures where curation is applicable).

What level of curation do you perform?
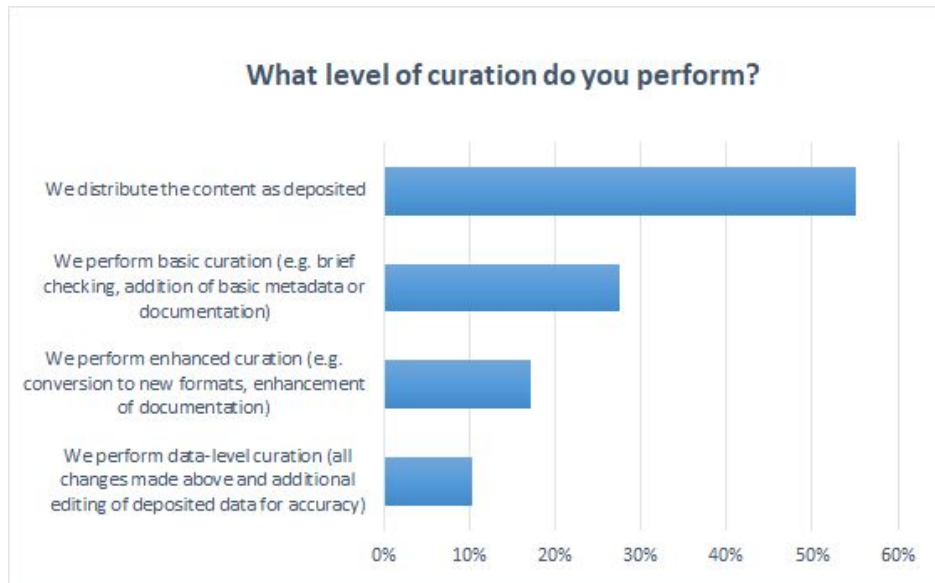
- **Compliance with FAIR principles**

We let the respondents self-evaluate how FAIR their data holdings are. According to the obtained information, approximately 23% of the participants consider their data very compliant with FAIR principles, 34% somewhat compliant and 14% not very much.

	Percentage
Very much	22,86%
Somewhat	34,29%
Not very much	14,28%
Not at all	0,00%
Not applicable	28,57%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=35 (2 infrastructures excluded, which stated that were not familiar at all with FAIR principles).

How FAIR do you consider your data holdings?
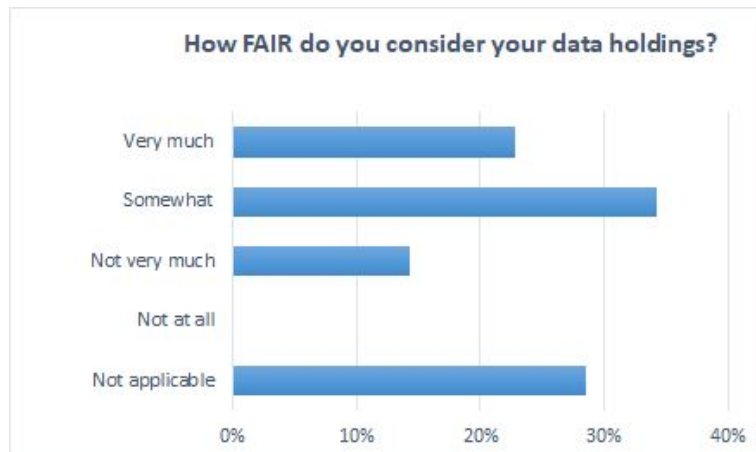
- **Machine readable data catalogues**

Among survey participants, there is a low percentage (around 5%) that present fully implemented data catalogues available in machine-readable formats. Approximately 21% of the participants have not implemented this feature and are not planning to implement it in the foreseen future.

	Percentage
This feature is fully implemented	5,41%
This feature is in the implementation phase	13,51%
We are working on or have a theoretical concept for this feature	32,43%
We have not considered this feature yet	21,62%
Not applicable	27,03%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=37.

Does your infrastructure provide a data catalogue in a machine-readable format?
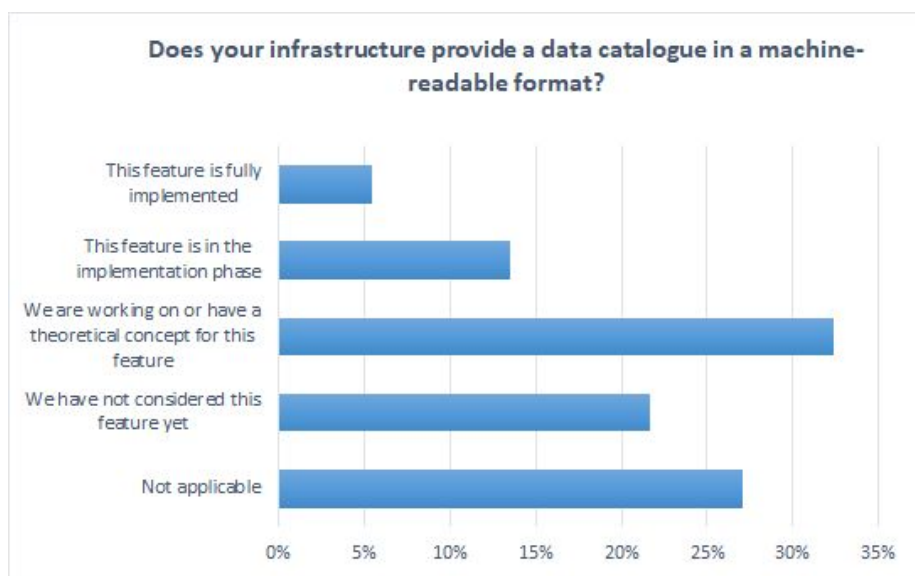
- **Implementation of PIDs and researcher identifiers**

According to the survey, around 43% of the participants are using ORCID as a unique identifier, and 19% are using ResearcherID. Some participants mentioned that they are using ScienceID and Research Gate.

	Percentage
Yes, ORCID	43,24%
Yes, ResearcherID	18,92%
No	21,62%
Other	8,11%
Not applicable	32,43%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; multiple choice question; N=37.

Does your infrastructure use unique identifiers for researchers in the metadata?
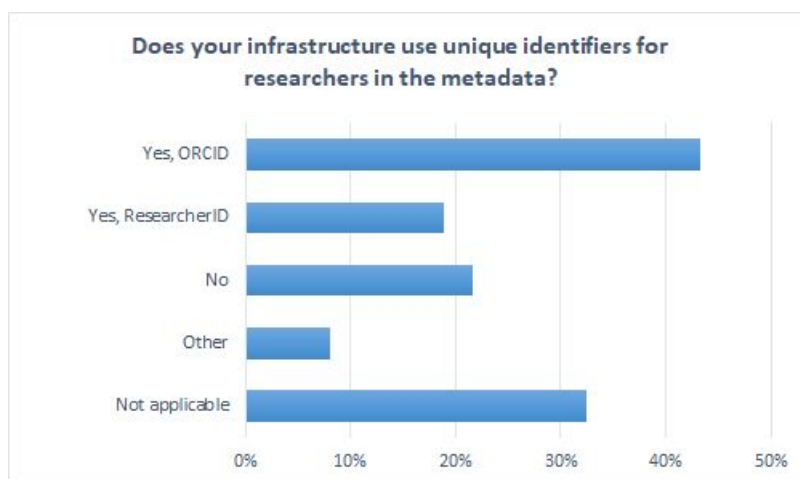
3.2.2 Data sharing and access

- **Access policies, restrictions and licenses**

Some infrastructures grant all users access to their services, some limit access to their services based on certain criteria. According to the survey, some organisations restrict access to its services to defined groups of users, however, roughly 54% of them do not apply any restrictions.

	Percentage
No access restrictions	54,05%
Users or communities approved by the funding body (e.g. due to regional or research topic restrictions)	16,22%
Users selected by competition	27,03%
Members of certain communities or organisations (e.g. virtual organisations)	8,11%
National users	10,81%
Not applicable	8,11%
Other	21,62%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; multiple choice question; N=37.

Does your infrastructure restrict access to its services to one or more of the following groups?
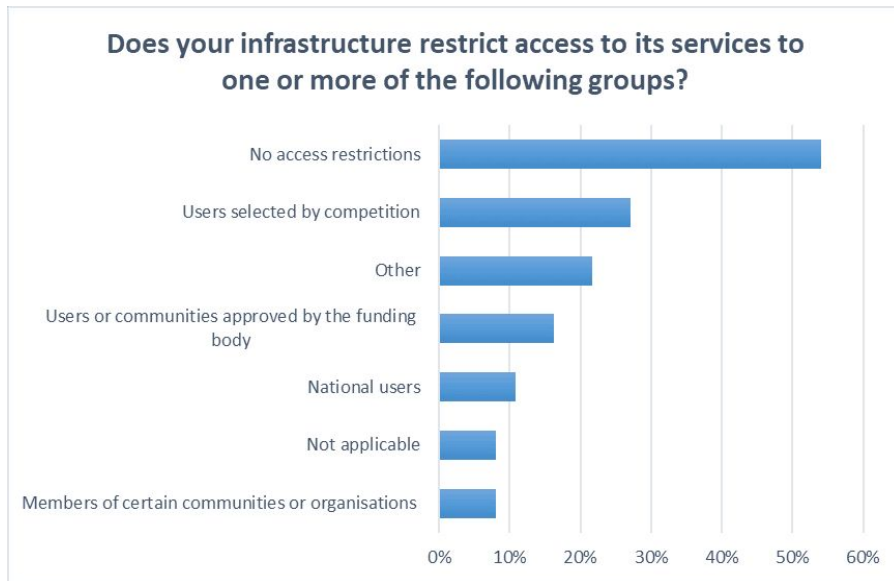
Investigation on public availability of access policy for digital services or data showed that 67% of the e-infrastructures services have publicly available access policy. The information is as follows:

	Data infrastructures which store and manage research data	High-bandwidth networks which transport research data	High-performance computing which can be used to process research data	Total Count	Total Percentage
Yes	1	1	2	4	66,67%
No	1	0	1	2	33,33%

Note: question was asked to **e-Infrastructures**; N=6 services provided by 4 e-Infrastructures.

Regarding e-infrastructures' services that stated that they do not have a public availability of access policy for digital services, they are planning to publish the access policy in less than one year.

|	Percentage
No	0,00%
Yes, in less than 1 year	100,00%
Yes, in 1 to 2 years	0,00%
Yes, in more than 2 years	0,00%
Not applicable	0,00%

Note: question was asked to **e-Infrastructures**; N=2 (e-Infrastructures services that responded "No" in the previous question)

● **Impediments to data sharing**

Some researchers or infrastructures are reluctant to share and/ or publish data, others are not. The conducted survey inquired both the research infrastructures and e-infrastructures on how concerned are their customers/ depositors on the following aspects:

	Not concerned at all	Somewhat concerned	Concerned	Very concerned	Don't know	Not applicable
Lack of control over the usage of data	27,03%	18,92%	29,72%	5,41%	10,81%	8,11%
Effort of preparing the data for publication	35,14%	35,14%	2,69%	5,41%	13,51%	8,11%
Doubts about the depositor's benefit of sharing data	10,81%	35,14%	21,62%	10,81%	10,81%	10,81%
Competitive disadvantage when sharing	21,62%	24,32%	27,03%	5,41%	10,81%	10,81%
Data protection	27,03%	29,73%	13,51%	8,11%	10,81%	10,81%
Intellectual property (e.g. copyright)	40,54%	21,62%	8,11%	10,81%	10,81%	8,11%
Other	12,50%	0,00%	0,00%	12,50%	25,00%	50,00%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; array question; N=37.

How concerned are your customers / depositors about the following aspects?
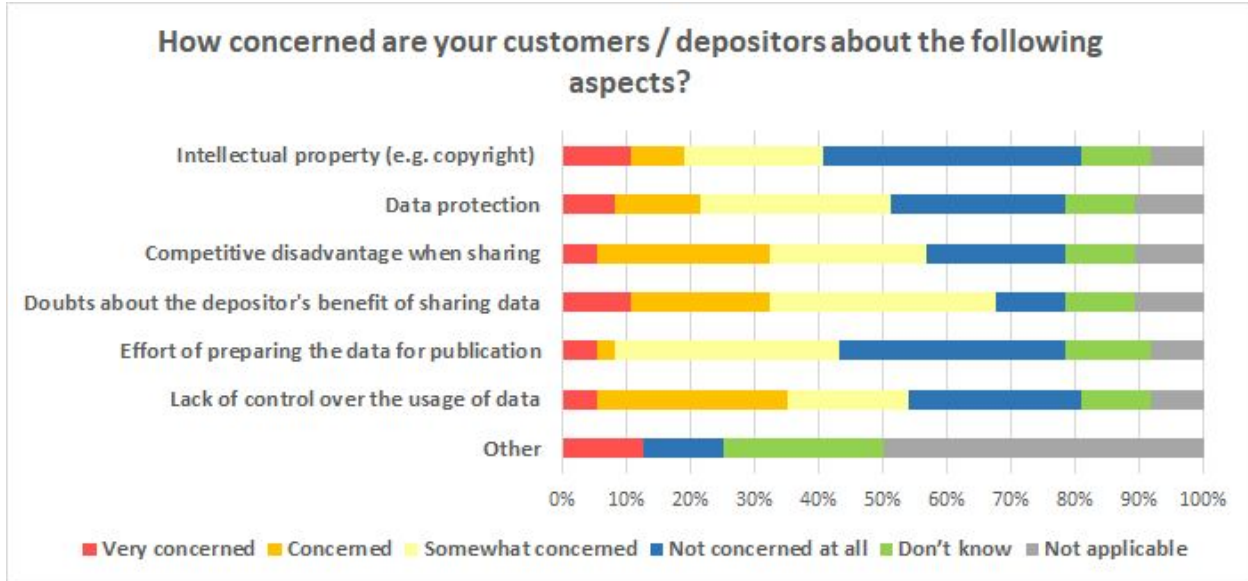
According to the respondents, the major concerns of their customers/depositors are related to intellectual property, effort of preparing the data for publication, lack of control over the usage of data and data protection. The caption other includes concerns about privacy, ethical issues and specific data handling, such as national security data.

- **Policies and limits to expansion of access for other groups**

The infrastructures were questioned on the existence of policies, procedural and/or technical barriers that limit the expansion of their digital services to further user groups. A high percentage of infrastructures do not present such barriers.

	Percentage
Yes	21,62%
No	72,97%
Don't know	5,41%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=37.

Does your infrastructure currently have policies, procedural and/or technical barriers that limit the expansion of your services to further user groups?

■ Yes ■ No ■ Don't know
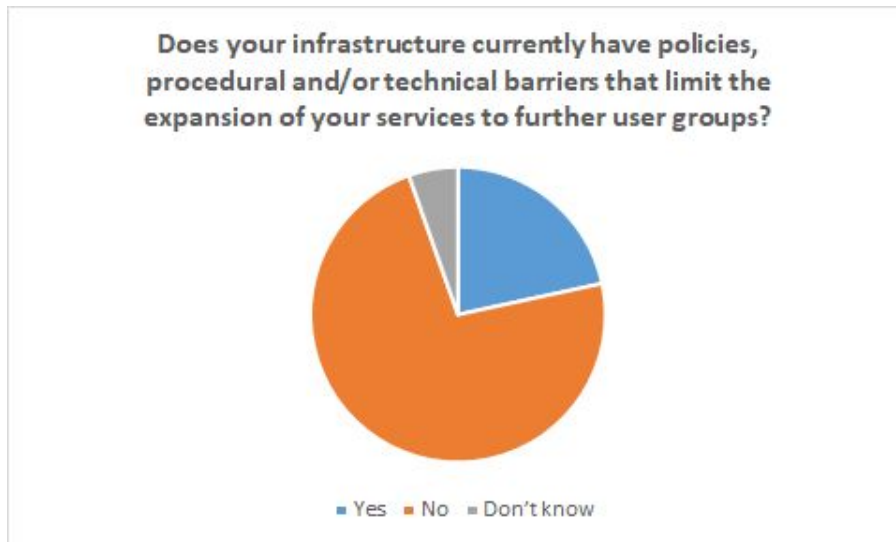
● **User charges**

The research infrastructures and e-infrastructures that responded that acquire their own revenues other than funding, were asked if they charge customers and users for services. The majority proceed with these charges: 40% for all services rendered and 50% for some services.

	Percentage
Yes, for all services	40,00%
Yes, for some services	50,00%
No	10,00%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=20 (infrastructures that responded previously that "acquire own revenues other than funding").

Does your infrastructure charge users/clients for services?

■ Yes, for all services ■ Yes, for some services ■ No
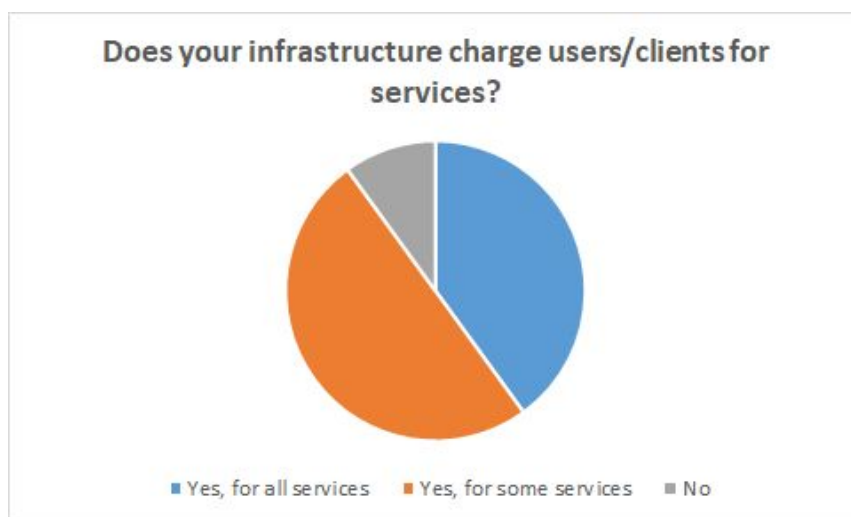
- **User characteristics and frequency of use**

When inquired about the groups of users that utilize the organisations' services, the information obtained was the following:

	Researchers based at universities	Researchers of non-university research institutions	Researchers of private, commercial institutions	Governmental institutions (e.g. census bureaus)	Students	Citizen Scientists	Professionals	Other
Never	0,00%	0,00%	2,70%	16,22%	2,70%	18,92%	5,41%	0,00%
Not very frequently	0%	32,42%	40,54%	24,32%	2,70%	29,72%	24,32%	0,00%
Frequently	37,84%	21,62%	29,74%	18,93%	37,84%	10,81%	16,22%	2,70%
Very frequently	56,76%	27,03%	13,51%	13,51%	45,95%	8,11%	16,22%	10,81%
Not applicable	2,70%	5,41%	2,70%	13,51%	2,70%	5,41%	13,50%	16,22%
Don't know	0,00%	5,41%	8,11%	2,70%	0,00%	16,22%	16,22%	16,22%
No answer	2,70%	8,11%	2,70%	10,81%	8,11%	10,81%	8,11%	54,05%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; array question; N=37.
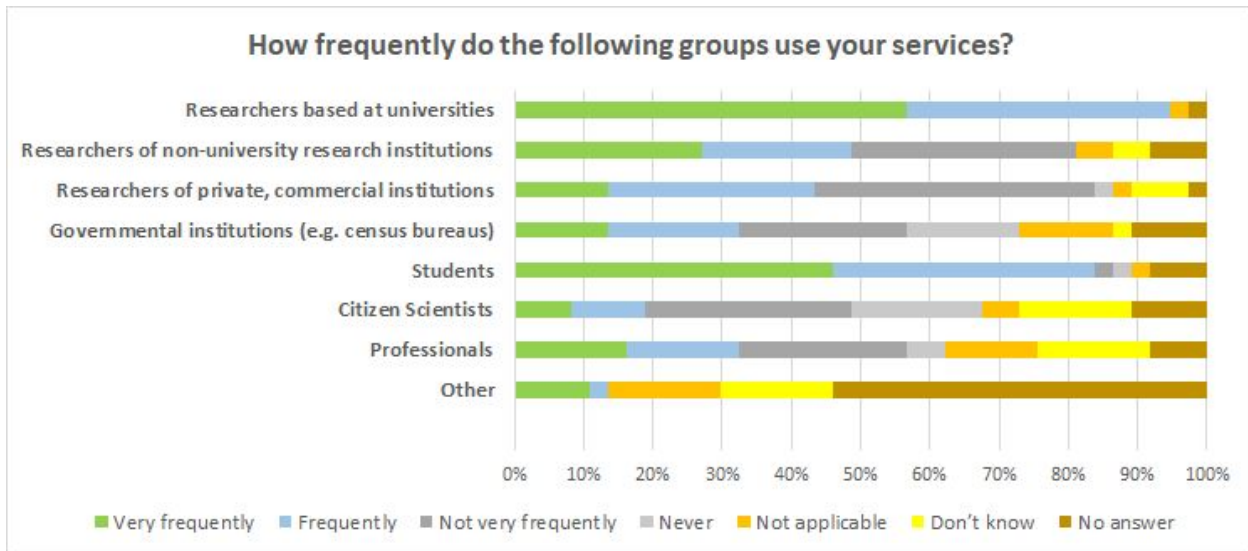
According to the data, the most frequent groups of users correspond to researchers based at universities, students and researchers of non-university research institutions.

- **Data search tools**

An important feature for FAIR data is the service of the search for research data. The survey shows that only approximately 8% of the infrastructures have this feature fully implemented. However, around 14% of the respondents are currently implementing this feature and 24% are working on or have a theoretical concept for it.

	Percentage
This feature is fully implemented	8,11%
This feature is in the implementation phase	13,51%
We are working on or have a theoretical concept for this feature	24,32%
We have not considered this feature yet	24,32%
Not applicable	27,04%
No answer	2,70%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=37.

Does your infrastructure provide a search feature for research data?
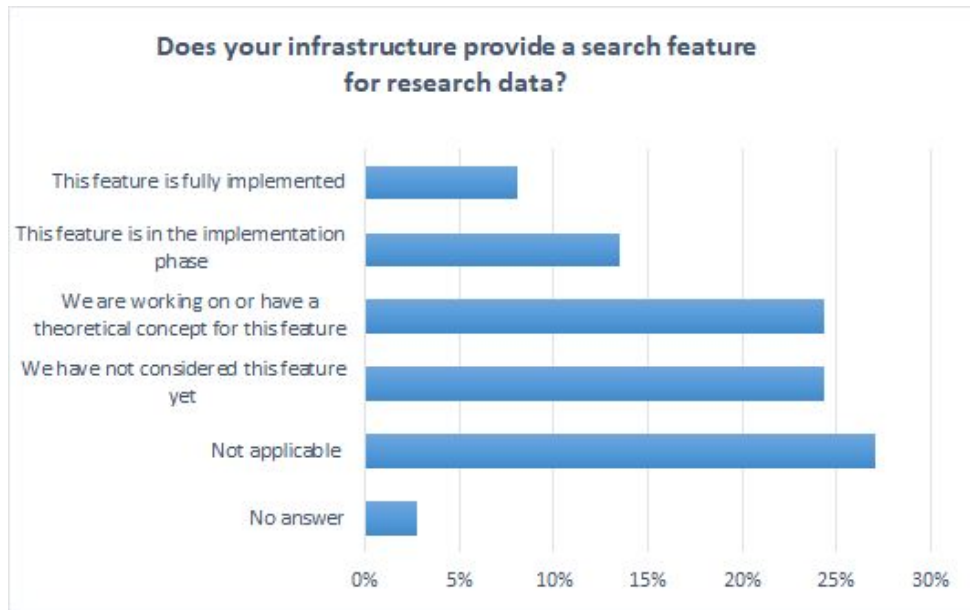
The organisations were also inquired about providing a search feature for metadata. The obtained information is similar when compared to research data. In fact, 8% of the respondents have this feature fully implemented, 8% are currently implementing this feature and 24% are working on or have a theoretical concept for it.

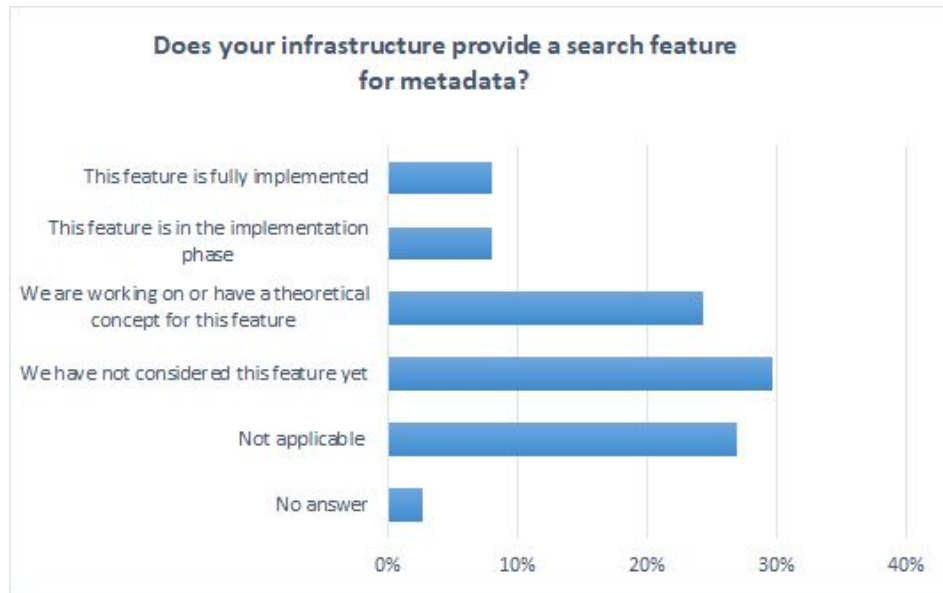|	Percentage
This feature is fully implemented	8,11%
This feature is in the implementation phase	8,11%
We are working on or have a theoretical concept for this feature	24,32%
We have not considered this feature yet	29,73%
Not applicable	27,03%
No answer	2,70%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=37.

Does your infrastructure provide a search feature for metadata?

● **Authorization and access control**

Methods of authorization of access to data vary although group membership, as well as mapping of group membership to the local file system are the most common processes of e-infrastructures.

	Percentage
Group membership: Members of groups can access all files open to the group	100,00%
Mapping of group membership to the local file system	75,00%
Access to datasets is authorized individually	25,00%
Service local authorization: users choose with whom they share files, (e.g. NextCloud or GoogleDocs)	25,00%
No access control, data is openly accessible	25,00%
Other	25,00%
Not applicable	25,00%

Note: question was asked to **e-Infrastructures**; multiple choice question; N=4.

The caption "other" includes authorization of access to data through the platforms managed by the user communities.

● **Access to and protection of personal data**

The e-infrastructures were also questioned if they offer services that process personal data in research data. According to the obtained answers, three participants responded affirmatively.

	Percentage
Yes	75,00%
No	25,00%

Note: question was asked to **e-Infrastructures**; N=4.

From these, none of the e-infrastructures offers services that process special categories of personal data in research data.

	Percentage
Yes	0,00%
No	100,00%

Note: question was asked to **e-Infrastructures**; N=3 (e-Infrastructures that responded to the previous question "Yes").

● **Access federation**

  ⬜ **Authentication model used**

Within the scope of the survey, the e-infrastructures were asked about the authentication model of their service. The information is the following:

	Data infrastructures which store and manage research data	High-bandwidth networks which transport research data	High-performance computing which can be used to process research data	Total Count	Total Percentage
Member of national federation	2	1	1	4	66,66%
Using EGI (Checkin)	1	0	1	2	33,33%
Using EUDAT (B2ACCESS)	1	0	0	1	16,66%
Local authentication (/etc/passwd)	1	0	1	2	33,33%
Other	1	1	2	4	66,66%

Note: question was asked to **e-Infrastructures**; multiple choice question; N=6 services provided by 4 e-Infrastructures.

The other authentication models used correspond to Federation Operator, local LDAP and Secure Shell.

 Implementation and need for support

The e-Infrastructures were inquired if they need implementation support outside their infrastructure to federate their services to EOSC. The answers were as follows:

	Data infrastructures which store and manage research data	High-bandwidth networks which transport research data	High-performance computing which can be used to process research data	Total Count	Total Percentage
Yes	0	0	1	1	16,67%
No	1	1	1	3	50,00%
Don´t know	1	0	1	2	33,33%

Note: question was asked to **e-Infrastructures**; N=6 services provided by 4 e-Infrastructures.

Half of the services provided will not need implementation support outside of their organisations to federate their service to EOSC. Two services were not able to provide the information. One service related to HPC stated that it would need this support.

□ **Plans for access federation**

The e-Infrastructures were questioned if they plan to authenticate their services through an Identity Provider (IdP). The four organisations considered this option as not applicable.

	Percentage
No	0,00%
Yes, in less than 1 year	0,00%
Yes, in 1 to 2 years	0,00%
Yes, in more than 2 years	0,00%
Not applicable	100,00%
Don't know	0,00%

Note: question was asked to **e-Infrastructures**; N= 4.

□ **Proxy to eduGAIN**

The e-Infrastructures were questioned if their service was proxied to eduGAIN. The answers were as follows:

	Percentage
Yes	0,00%
No, we don't use a proxy	0,00%
Don't know	0,00%
No, we use a different service provider-identity provider (SP-IdP) proxy	100,00%

Note: question was asked to **e-Infrastructures**; N= 4.

All e-infrastructures use a different service provider-identity provider proxy. For instance, INCD supports eduGAIN through the EGI Check-in.

 Management of authorisation information

So that infrastructures services become part of a federation, these services cannot rely on locally managed attributes only. The e-Infrastructures were questioned if the authorisation information for their services are managed locally at the service level or received from an external attribute authority. The four e-infrastructures responded that the attributes are managed locally and received from an external authority.

	Percentage
Attributes are managed locally	0,00%
Attributes are received from an external authority	0,00%
Both, managed locally and received from an external authority	100,00%
Not applicable	0,00%

Note: question was asked to **e-Infrastructures**; N= 4.

 Use of REFEDS R&S entity category

The REFEDS Research and Scholarship Entity Category (R&S) has been designed as a simple and scalable way for IdPs to release minimal amounts of required personal data to service providers.
The conducted survey inquired e-Infrastructures if they use the REFEDS R&S entity category. The answer was affirmative for the four e-Infrastructures:

	Percentage
Yes	100,00%
Yes, in less than 1 year	0,00%
Yes, in 1 to 2 years	0,00%
Yes, in more than 2 years	0,00%
No	0,00%

Note: question was asked to **e-Infrastructures**; N= 4.

# 4 Procurement of and transnational access to services and resources compatible with EOSC

4.1 Transnational access to national resources/services

This chapter displays information on the access to national resources and services.

In the survey, the research infrastructures and e-infrastructures were questioned if they are offering services cross-border. According to the obtained answers, approximately 65% of the organisations do not offer services cross-border.

|	Percentage
No	64,86%
Yes	18,92%
Not applicable	16,22%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=37.
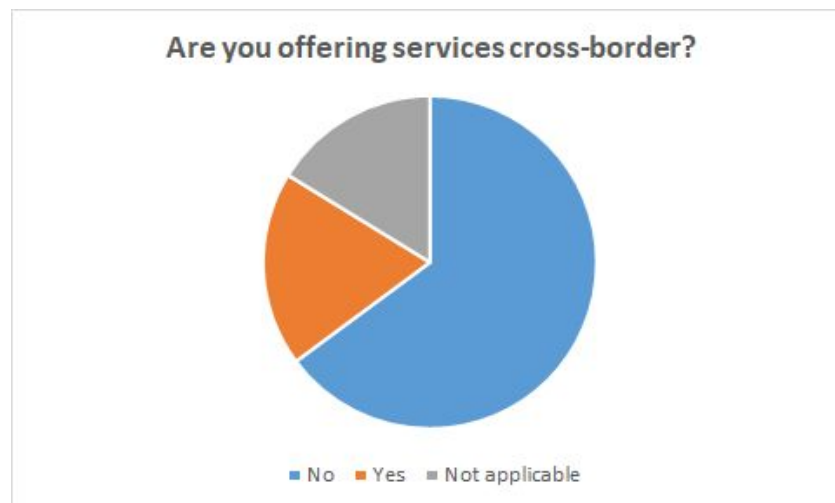
The infrastructures were also questioned if there are any differences in access rights or extent (e.g. capacity available) between national and international users:

	Percentage
No, all users are treated equally	78,38%
Yes, national users are prioritised	8,11%
Yes, international users are not allowed without clear link/relation with natural users	0,00%
Yes, international users are not accepted	0,00%
Not applicable	13,51%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=37.
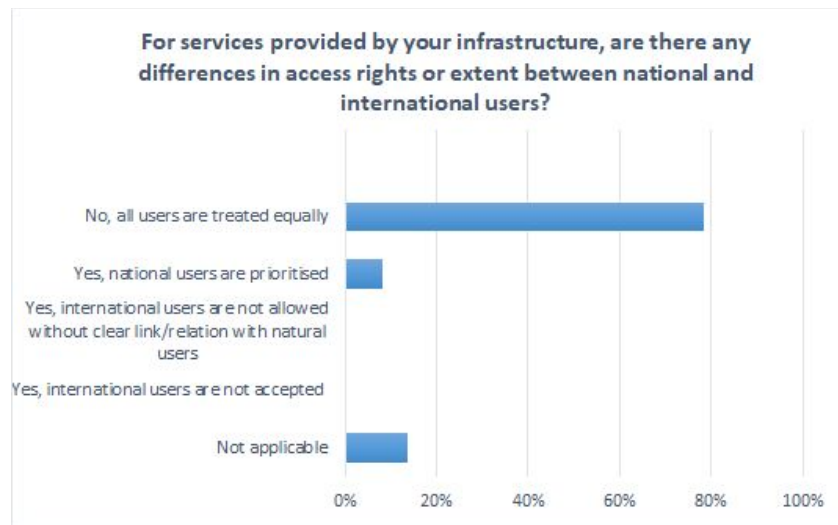

Approximately 78% of the infrastructures reported that all users are treated equally. For the case of national users being prioritised, the following reasons are mentioned:

- *"Although the principle is that all users from all nationalities are to be treated equally it is expected that the community providing those services will always hold priority."*

- *"We only accept international users if related to a national project, research collaboration or infrastructure."*

The infrastructures were also asked if they have any experience with international service tenders (e.g. cloud service provisioning). A significant percentage states that the infrastructures do not present this type of experience.

|	Percentage
Yes	18,92%
No	81,08%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=37.
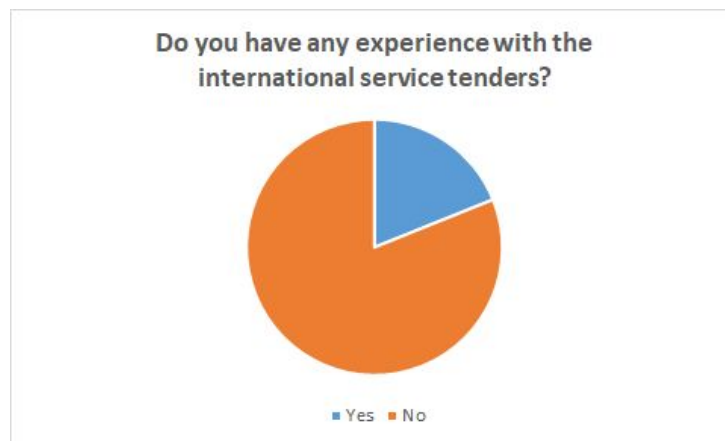
The infrastructures were also questioned about their expectations on EOSC's support within procurement:

	Percentage
Providing funding to cover costs of international users	40,54%
Providing more trusted environment (e.g. identity vetting)	24,32%
Removing policies differences (at national levels)	10,81%
Other	18,92%
No answer	5,41%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=37.

Where do you expect/want EOSC to help?
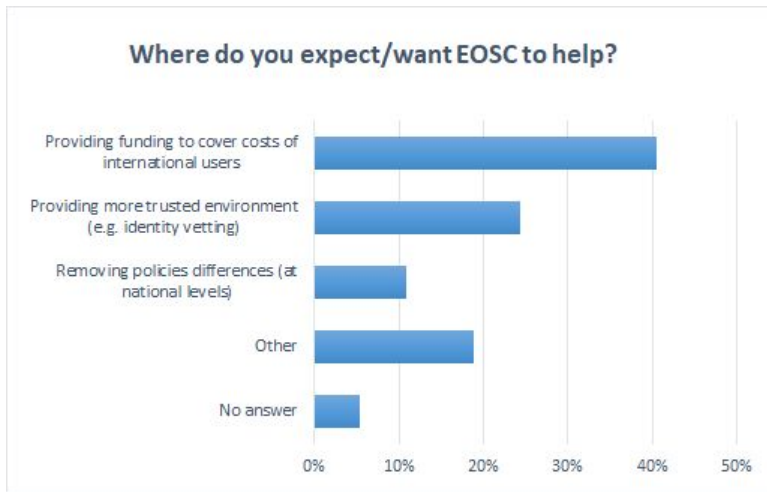
Approximately 41% of respondents referred the need of funding to cover costs of international users, 24% the need of a more trusted environment, and 19% stated other needs, such as:

- *"Funding that allows us to hire someone that directly works with EOSC and other data platforms";*
- *"Facilitate data access";*
- *"Helping in making data available to a wider range of users".*

4.2 Potential for harmonization of national policies for:

4.2.1 Joint procurement

In terms of collaboration within procurement, the infrastructures were asked if they joint with other organisations.

	Percentage
No	29,73%
Yes, but just informing each other	35,14%
Yes, we do a joint tender	16,22%
Not applicable	24,32%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; multiple choice question; N=37.

When procuring services, are you collaborating with other infrastructures/organisations?
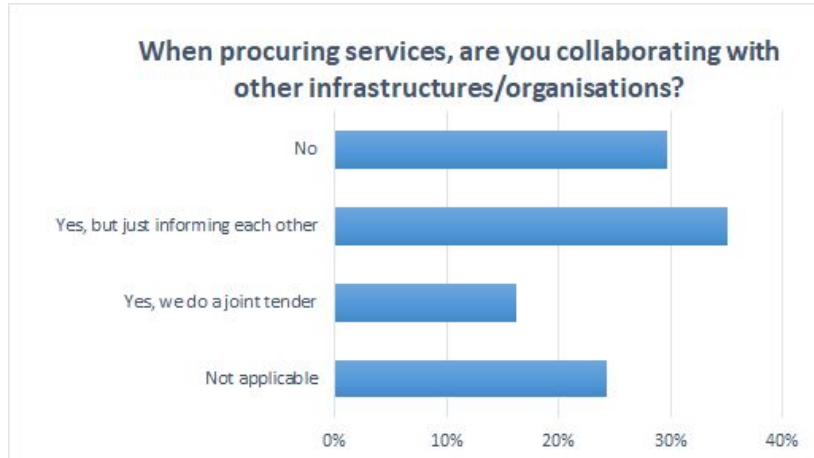
From the analysis, only six respondents of the survey are actually performing joint tenders. The higher percentages reveal that there is a collaboration but just informing other infrastructures/organisations, as well as no collaboration at all.

For the group of infrastructures that are collaborating with other infrastructures/organisations, the allocation in terms of scope is as follows:

	Percentage
National level	77,77%
International level	66,66%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; multiple choice question; N=18 (infrastructures that are collaborating with other infrastructures/organisations).

Collaboration with other infrastructures/ organisations
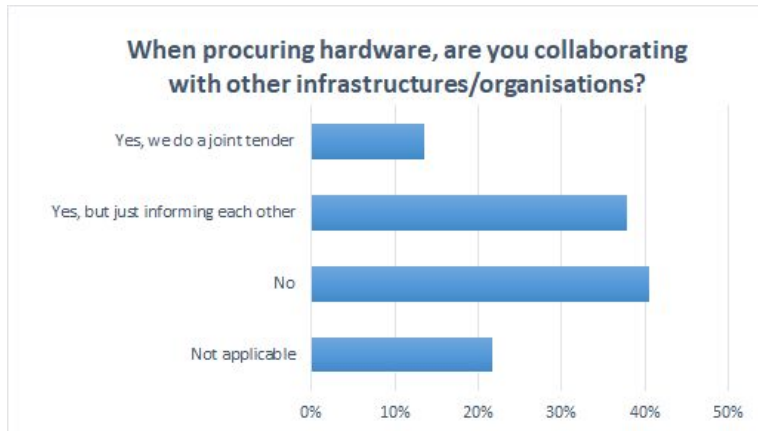

■ National level ■ International level
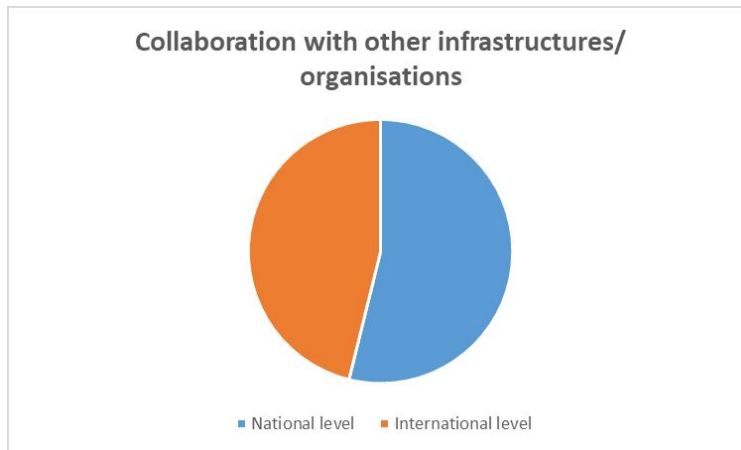
The collaboration reveals a close percentage in what concerns national and international level. Six infrastructures collaborate only at national level, while four collaborate only at international. Eight infrastructures collaborate at both levels.

In what concerns specifically hardware procurement, the answers are the following:

	Percentage
Yes, we do a joint tender	13,51%
Yes, but just informing each other	37,84%
No	40,54%
Not applicable	21,62%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; multiple choice question; N=37.

When procuring hardware, are you collaborating with other infrastructures/organisations?

For the infrastructures that collaborate with other organisations, the scope is the following:

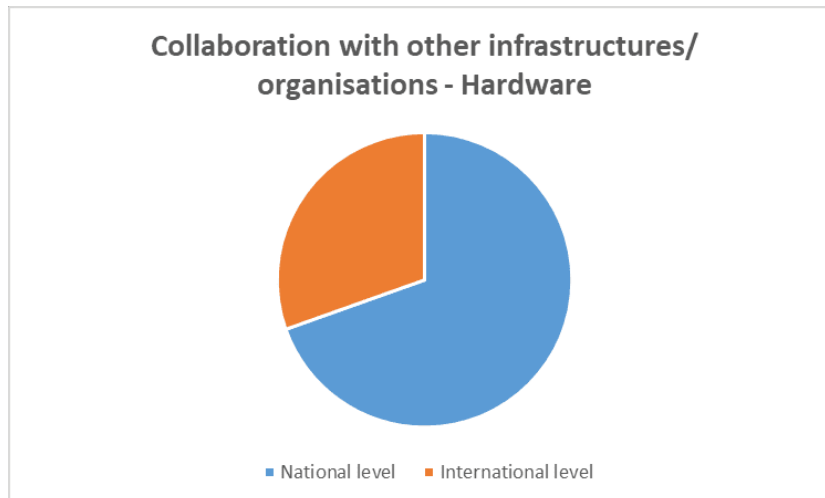|	Percentage
National level	88,89%
International level	38,89%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; multiple choice question; N=18.

Collaboration with other infrastructures/ organisations - Hardware

The major obstacles that the infrastructures face on service or hardware procurement, that imply a non-collaboration are the following:

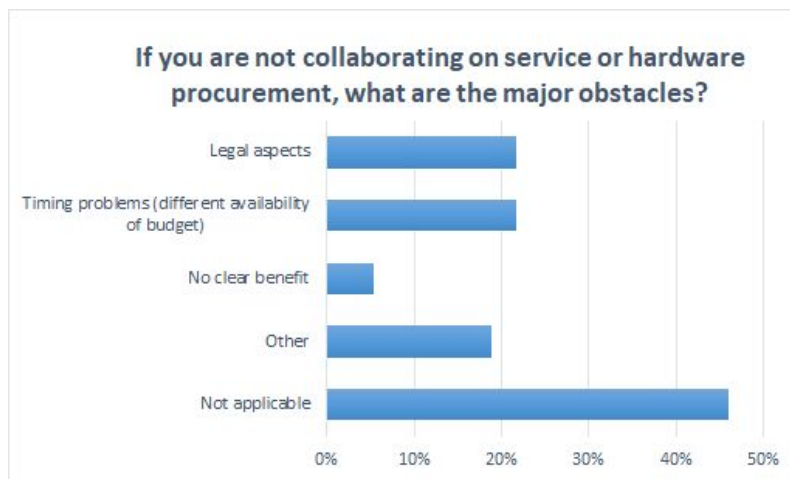|	Percentage
Legal aspects	21,62%
Timing problems (different availability of budget)	21,62%
Other	18,92%
No clear benefit	5,41%
Not applicable	45,95%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; multiple choice question; N=37.

Seventeen infrastructures referred to this question as not applicable. In an identical percentage, the major obstacles identified are timing problems, legal aspects and other that include:

- *"The funding limitations don't allow us to acquire services";*
- *"Tenders based on individual budgets in joint projects";*
- *"Needs are very specific";*
- *"No need yet".*

4.2.2 Coordinated service provisioning

Over the past years, an increasing number of national services have worked towards international collaboration and coordination. In this section, we present important alignments and cooperations between national and international entities.

IBERGRID[40] was formed in accordance with the agreement of Scientific and Technological cooperation between Spain and Portugal, in 2003. Two years later, in 2005, collaboration agreements were signed in terms of grid technologies and communication networks for research and development. In 2006, a joint Hispanic-Portuguese Commission was set up in order to coordinate the e-Infrastructures of the two countries. The participation of Portugal in IBERGRID takes place within the framework of INCD, which integrates and manages resources from LIP, LNEC and several other organizations.

RNCA also integrates the Iberian Network of Advanced Computing (RICA), in accordance to the Memorandum of Understanding (MoU) between the Portuguese and the Spanish Government, signed in 2018.

Portugal is also a member of the EuroHPC Joint Undertaking[41] that will contribute to create a synergy on European resources, in order to develop top-of-the range exascale supercomputers for processing big data, based on competitive European technology. FCT is developing a national advanced computing network, which will integrate resources from EuroHPC Joint Undertaking.

As referred in chapter 1.3.1, there are also partnerships with PRACE, EGI and GÉANT, respectively through UC-LCA, INCD and RCTS.

4.3 Procuring services/resources

The Portuguese Public Contracts Code (CCP) approved by **Decree-Law n. 18/2008[42]**, governs the public procurement and the Government contracts under the Portuguese legal system.
In August 2017, the CCP was amended by **Decree-Law n. 111-B/2017[43]**, implementing into the Portuguese legal system four European Directives that set clear rules on:

- Concession contracts;

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[40] https://wibergrid.lip.pt/site/

[41] https://eurohpc-ju.europa.eu/index.html

[42] http://www.pgdlisboa.pt/leis/lei_mostra_articulado.php?nid=2063&tabela=leis

[43] https://dre.pt/web/guest/home/-/dre/108086621/details/maximized?res=en

- Public procurement;
- Special sectors;
- Electronic invoicing.

In addition, the amendment introduced measures to simplify and increase flexibility on procurement procedures.

It is important to mention that the CCP displays an important focus on scientific and technological development. In fact, it adapted the administrative procedures from the R&D institutions enabling the national and international activities or agreements to occur in a regular and sustained way.
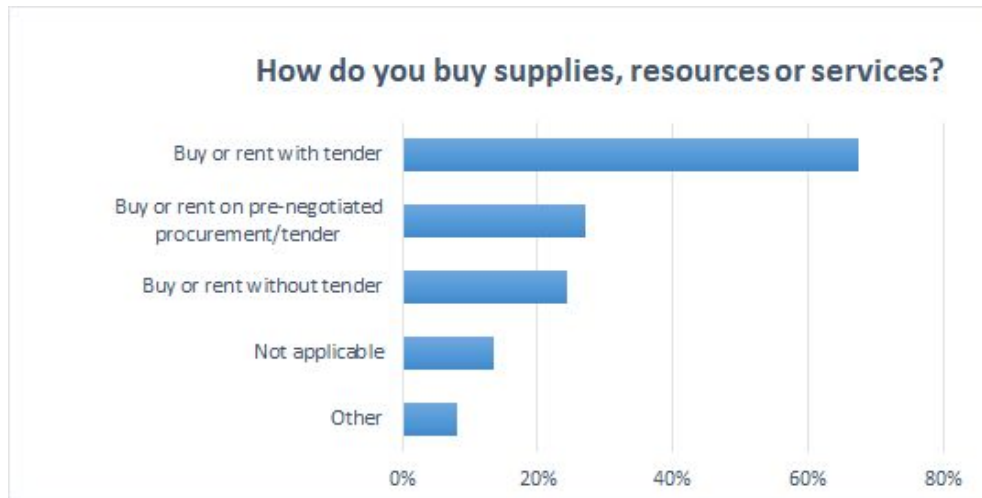
More recently, in May 2018, the CCP was amended through **Decree-Law n. 33/2018**[44] and some important changes were introduced in R&D activities. In fact, the acquisition of certain services related to R&D might be exempt from Part II of the CCP, and therefore the type of procedures and amounts might differ, resulting in a more simplified process. For more detail, please refer to **Appendix B**.

In the survey, the infrastructures were questioned on how they buy supplies, resources or services. The answers and percentages are as follows:

	Percentage
Buy or rent with tender	67,57%
Buy or rent on pre-negotiated procurement/tender	27,03%
Buy or rent without tender	24,32%
Not applicable	13,51%
Other	8,11%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; multiple choice question; N=37.

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[44] https://dre.pt/home/-/dre/115312061/details/maximized

How do you buy supplies, resources or services?

Recurrent answers relate to the buying and renting supplies, resources or services with tender, followed by a pre-negotiated procurement/tender. Three infrastructures stated that:

- *"The funding limitations don't allow us to acquire supplies, resources or services";*
- *"Supplies, resources or services provided by nodes (universities)";*
- *"According to public financing rules".*

In the survey, the infrastructures were also inquired if they know the unit cost of services, as well as its level of granularity. The information is as follows:

	Percentage
Yes, cost per service	43,24%
No, but in preparation	18,92%
Not currently available, but could be calculated	16,22%
Yes, cost per set of services	10,81%
No, not possible/ not foreseen	10,81%
No answer	0,00%

Note: question was asked to **Research Infrastructures** and **e-Infrastructures**; N=37.

Does your infrastructure know the unit cost of your services? If yes, what is the granularity?
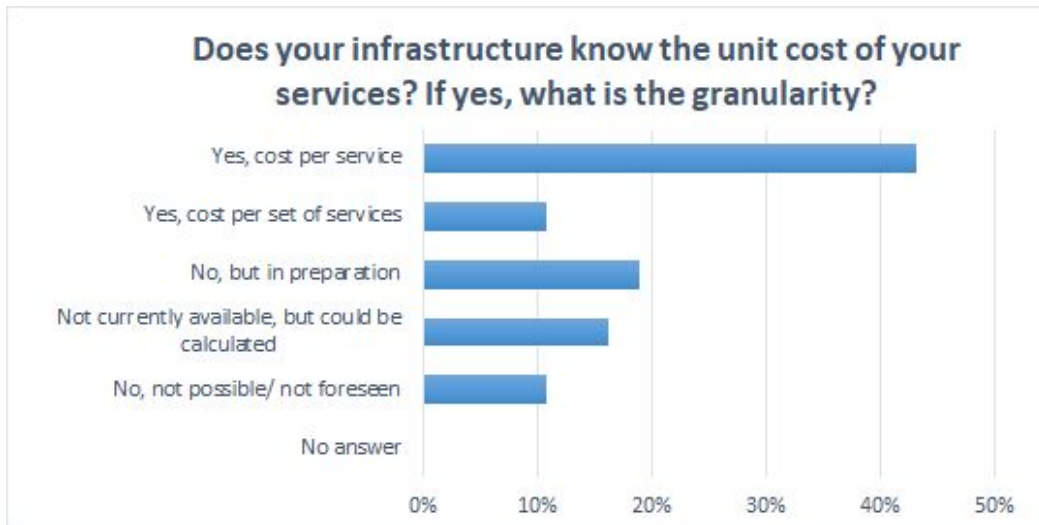
From the thirty-seven infrastructures, sixteen infrastructures stated that they are able to know the unit cost of services with a high level of granularity. Seven infrastructures referred that do not know the unit costs of the services level, although the process is preparation. Six infrastructures stated that these data are not currently available, but could be calculated.

5 Conclusions

This chapter presents the main conclusions on the national landscape with respect to research infrastructures, open science data and open science policies.

The landscape in Portugal shows two main categories of research infrastructures and e-infrastructures: entities that produce and consume computing and data processing services, which are mainly related to ESFRI, and research infrastructures as computing and data services providers, which work towards international coordination with projects such as EGI, PRACE, GÉANT, EuroHPC Joint Undertaking, OpenAIRE and IBERGRID.

Open science has been considered a priority to the Portuguese Government and MCTES. Recently, MCTES has commissioned the open science agenda to FCT, which intends to develop a national research data roadmap and review and update the current data policy in order to contribute to the implementation of data management best practices. Also, a strong collaboration with the research communities has been present since the beginning of FAIR activities in Portugal.

Lastly, it is important to mention that Portugal has been participating in several EOSC projects and initiatives.

5.1 Perceived gaps in the landscape

This section displays the perceived gaps of the national landscape, according to the analysis:

- There is still a significant number of national infrastructures that are not familiar with EOSC initiative. It also seems unclear to some infrastructures what the benefits of implementing EOSC would be. There is a lack of dissemination of positive use cases and demonstrations, as well as of issues and risks that could be mitigated, and could clearly demonstrate the importance of EOSC;

- At the moment, Portugal does not have a National Data Strategy, although this process is currently being developed. Also, the implementation of FAIR data principles at a national level will be of great importance.

- In accordance with survey results there is the need to implement and improve data management processes within the community. The implementation of data management plans in research

projects, the adoption of FAIR principles, the curation process, the certification of repositories, the accessibility of data and metadata and their sharing and reuse, represent improvement areas;

- The policy currently in force on the management and sharing of data resulting from public-funded research is not mandatory. In fact, the policy incorporates only a set of recommendations. FCT is currently working on the update and broader scope of data policy, following recommendations from Science Europe, as well as requirements from Horizon 2020 and Horizon Europe programmes;

- A significant number of services and infrastructures depend, to a substantial extent, on project funding;

- Incentives and rewards for the research community are still at an early stage of awareness creation;

- There is still low visibility of Portuguese research infrastructures services in EOSC, namely in EOSC Marketplace;

- Lastly, it is important to mention that Portugal has few qualified resources in this area.

5.2 Overlaps in the landscape

Various national entities already are members or participate in several global initiatives. In order to avoid overlaps on the Portuguese landscape, it is important to take into account the coordination of the national players and decision-making processes.

5.3 Harmonisations of the landscape

Portugal is invested in promoting Open Science and contributing to the EOSC initiative. Some of the factors that might contribute to the harmonisation of the landscape towards EOSC are:

- A definition of governance and a sustainability model;
- Foster collaboration with EU level infrastructures;
- Higher awareness within the community, as well as the dissemination of EOSC data services;
- The implementation of a Data Strategy and adoption of FAIR principles at a national level;
- Funding to cover specific costs from research infrastructures.

Appendix A – Acronyms

ANI	National Innovation Agency
CCP	Portuguese Public Contracts Code
CERN	European Laboratory for Particle Physics
CNCTI	National Council for Science, Technology and Innovation
CNEI	National Council on Entrepreneurship and Innovation
EGI	European Grid Infrastructure
e-IRG	e-Infrastructure Reflection Group
EOSC	European Open Science Cloud
ESFR	European Synchrotron Radiation Facility
ESFRI	European Strategic Forum on Research Infrastructures
ESO	European Southern Observatory
FCCN	National Scientific Computing Unit
FCT	Foundation for Science and Technology
HPC	High Performance Computing
HTC	High-Throughput Computing
IAPMEI	Competitiveness and Innovation Agency
IBERGRID	Iberian Distributed Computing Infrastructure
INCD	National Distributed Computing Infrastructure
ITER	International Thermonuclear Experimental Reactor
UC-LCA	Laboratory for Advanced Computing
LIP	Laboratory of Instrumentation and Experimental Particles Physics
LNEC	National Laboratory for Civil Engineering
MACC	Minho Advanced Computing Centre
MCTES	Ministry of Science, Technology and Higher Education
MoU	Memorandum of Understanding
NCP	National Contact Point
NIS	National Innovation System

PNCA	National Policy for Open Science
R&D	Research and Development
R&I	Research and Innovation
RCAAP	Scientific Open Access Repositories of Portugal
RCTS	Science, Technology and Society Network
RDA	Research Data Alliance
RICA	Iberian Network of Advanced Computing
RNCA	National Network of Advanced Computing
SKA	Square Kilometre Array
SLTs	Service Level Targets
WLCG	Worldwide LHC Computing Grid

Appendix B – Procurement process – Portuguese Public Contracts Code

The Portuguese Public Contracts Code (CCP) approved by Decree-Law n. 18/2008, governs the public procurement and the Government contracts under the Portuguese legal system.

More recently, the CCP was amended by Decree-Law n. 111-B/2017, with the objective to implement into the Portuguese legal system the following European Directives:

- Directive n. 2014/23/EC - Concessions contracts Directive;
- Directive n. 2014/24/EC - Public procurement Directive;
- Directive n. 2014/25/EC - Utilities Directive;
- Directive n. 2014/55/EC - Electronic invoicing Directive.

The Portuguese legislation currently recognizes three main categories of contracting authorities:

- Public sector entities, including the Portuguese State, public institutes, public foundations and associations financed, for the most part, by the previous entities or subject to management supervision of those authorities;
- Bodies governed by public law;
- Entities operating in the utilities sectors.

The contracts that are subject to procurement regulation are those whose scope is, or may be, subject to competition. According to the CCP, the contracts that are considered to be subject to competition, without limitation are as follows:

- Public works contracts;
- Public works concessions;
- Public services concessions;
- Acquisition or lease of goods;
- Acquisition of services;
- Company contracts.

In what concerns acquisitions or lease of goods and services, the type of procedures are the following:

- Simplified Direct Award: ≤5.000 € and no consultation needed;
- General Direct Award: > 5.000 € and < 20.000 € and consultation with a single company;

- Preliminary Consultation: ≥ 20.000 € and < 75.000 € and consultation of three entities;
- National Public Tender: Less than the applicable Community threshold, 221.000 €;
- Urgent Public Tender: Less than the applicable Community threshold, 221.000 €;
- International Public Tender - Any amount.

The CCP presents an important focus on scientific and technological development. In fact, the CCP adapted the administrative procedures from the R&D institutions enabling the national and international activities or agreements to occur in a regular and sustained way.

In May 2018, the CCP was amended by the [Decree-Law n. 33/2018](). Some important changes were introduced in R&D activities:

- The <u>acquisition of services related to R&D</u> is exempt from Part II of the CCP, except for R&D contracts associated with the following Common Procurement Vocabulary (CPV) codes:
    - o   730000002 – R&D services and related consultancy services;
    - o   731200009 – Research and experimental development services;
    - o   733000005 – Design and execution of research and development
    - o   734200002 – Pre-feasibility study and technological demonstration;
    - o   734300005 – Tests and evaluation.

    For the non-excluded contracts under R&D activities the type of procedures and amounts are the following:

    - o   General Direct Award: Up to 221.000 €, applying criteria in Article n. 27;
    - o   General Direct Award: No amount defined, applying criteria in Article n. 24.

- The <u>acquisition of goods</u> for research, experimentation, study or development purposes might adopt the following procedures:
    - o   General Direct Award: Up to 221.000 €, under the terms of Article n. 26;
    - o   General Direct Award: No amount defined, applying criteria in Article n. 24.