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Open Science in aeronautics: Survey on the existing practices and expectations

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1 Summary

WP2 aims at capturing the current extend that Open Science principles are applicable in the AAT Research performed in Europe.

In the frame of task 2.2, a thorough consultation phase with participants from Universities, Research Establishments as well as from Industry has been performed. In this context, two online surveys (a Mini Survey and a Big-Survey) as well as a remarkable number of virtual interviews have been conducted aiming to gain a comprehensive insight on the existing practices and expectations of the stakeholders and obtain their point of view for the application of Open Science principles in aeronautical research in Europe.

The results of both surveys and the interviews have been analysed and assessed and presented in this deliverable.

This deliverable D2.2 is comprised of this text document and additional data and documents, specified as attachments to this deliverable:

- OSCAR GA 824350 Deliverable D2.2 v1-0 2020-10-31.docx
- D2-2 - Attachment 01 – OSCAR_Mini Survey_Poster_2019-05.pdf
- D2-2 - Attachment 02 – OSCAR_Big-Survey_Onepager_2019-12-09.pdf
- D2-2 - Attachment 03 – OSCAR_Big-Survey_2019-09-10.pdf
- D2-2 - Attachment 04 – OSCAR_Mini-&-Big-Survey_Analysis_SPSS_Input.xlsx
- D2-2 - Attachment 05 – OSCAR_Mini-&-Big-Survey_Analysis_SPSS_Results.docx
- D2-2 - Attachment 06 – OSCAR_Interview_GDPR_2020-07-13.pdf
- D2-2 - Attachment 07 – OSCAR_Interview_Infopack_OPEN SCIENCE.pdf

2 Objectives and Task

WP2 is a preparatory WP for the work to be performed in the following work packages WP3 to WP5. The overall objective of this work package is to capture the current extend that Open Science principles are applicable in the AAT research performed in Europe.

To this end the spectrum of AAT research stakeholders and proper communication channels have been identified. Utilizing properly developed interview material (e.g. questionnaires), two surveys on the existing practices and expectations were performed. The results were analyzed and codified to serve the development of OSCAR code of conduct in WP4. Additionally, individual representatives from aviation and air transport research covering a wide range of technological areas in AAT sector were interviewed in order to gain deeper insight into specific topics of interest which were identified by the implementation of the surveys.

The results from the surveys and the interviews as well as the concluding remarks on the performed activities are presented in this deliverable.

2.1 Objectives of the Related OSCAR WP2 and OSCAR Task T2.2

The specific objectives of WP2, and in particular of Task 2.2, is to capture the current perception of the AAT community with respect to Open Science as well as the degree of the implementation of Open Science principles in Aviation Research. In this context, the specific goals of the two surveys and the interviews were to acquire knowledge on the following:

- Awareness of Open Science as well as Open Science concepts
- Degree of importance of Open Science for a business or organization
- Opportunities by the implementation of Open Science in aviation research
- Possible risks by the implementation of Open Science in aviation research
- Working with Open Science: Perception of the already developed platforms and content
- Understanding the differences between industry and research with regard to Open Science
- Infrastructure and facilities for the implementation of Open Science
- High-hopes for the implementation of Open Science in the future

The results of the surveys are expected to reveal the key issues that have to be addressed so as to facilitate the implementation of Open Science principles in aeronautical research in Europe.

The Mini survey was rolled out in time for the AEROdays 2019. The Big Survey was built on the results of the Mini Survey. The Structured Interviews followed a thread which was developed on the basis of the Big Survey results. Collected information from these initiatives was analyzed and assessed in order to provide a clear picture of the AAT landscape with respect to Open Science and identify changes and new developments. This includes general opinions and perceptions as well as interests, constraints and sensitivities that may exist in specific stakeholder groups (industries, research establishments, universities, etc.).

An ongoing activity is the continuous monitoring of the landscape to identify changes and all kind of new developments. This includes changes to policies, new or emerging Open Science platforms or services, and especially any new content that is being added and made available for Open Science users.

It needs to be underlined that most of the information was gathered before the Covid-19-crisis completely shook up the aviation and air transport sector. Although the fallout of the crisis was already addressed in some interviews at the time of this report, it has been still too early to get

conclusive results about the impact on the sector and the resulting consequences on Aviation Research in general and the perception and acceptance of Open Science in AAT in particular¹.

2.2 Relevance and Contribution of the Deliverable to the Objectives of OSCAR

The project OSCAR – Open Science Aeronautic & air transport Research – addresses the current perception, acceptance, and implementation of Open Science in the field of European AAT research as well as in fields where European AAT research issues interact with e.g. other transport modes, exploitation of Hydrogen, Batteries, etc. As a main deliverable and as a main objective of the OSCAR project will be an optimized Open Science concept to European transport with special focus on AAT research.

The present deliverable which aims to capture the current perception of the existing practices and expectations of the AAT community with respect to Open Science, fits to the objectives of the OSCAR project and contributes to achieve its deliverables.

¹ Notice: There was no question directly addressing the impact of COVID-pandemic on the AAT sector in the surveys and the interviews, yet some interviewees have raised the issue. Furthermore, a survey about the impact on AAT sector has been conducted by EASN and the results showed that the AAT sector has been severely affected. The results of the surveys can be seen in the following link: <https://easn.net/newsletters/issues/easn-newsletter-december-2020> and in the EASN website: www.easn.net.

3 Approach, Intention and Procedure

3.1 Approach & Methodology

To achieve the goals of this work, two public online surveys (the Mini and the Big Survey) as well as Structured Interviews were designed. For the interviews, persons from AAT research as well as some individuals outside AAT research were contacted. A brief overview of the three activities performed are presented in the following Figure.

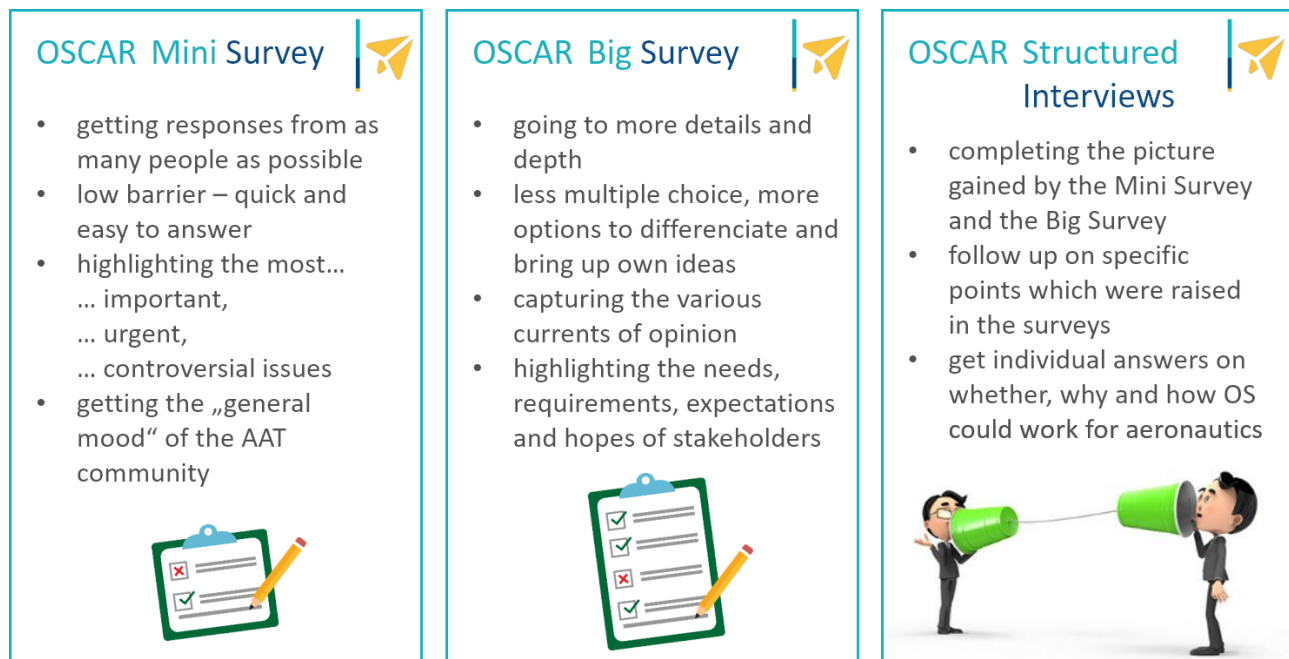


Figure 1: Overview of the activities performed (Mini Survey, Big Survey and Structured Interviews)

All three activities follow a clear path that started by reaching out as broadly as possible and continued by zooming in onto the most relevant, controversial or outstanding issues and topics.

3.1.1 Activity 1: Mini Survey

The first survey, the Mini Survey, was limited to a few general questions about the awareness of participants on Open Science as well as on Open Science concepts. In addition, people's views on a limited number of significant aspects related to Open Science were also pointed out. The goal was to have a quick-and-easy-to-answer survey so as to gather a high number of participants from a wide range of areas in AAT research. Another target of the Mini Survey was to obtain the contact information of participants who would be willing to take part in the next activities within this deliverable, the Big Survey and the interviews. In addition, a first picture of the views of employees from different sectors and hierarchies was obtained.

The tool that was used for the survey was LimeSurvey, which is an appropriate online platform for creating and conducting a survey. In consistency to the open source idea, the source code is offered for free download. The requirements for using such a code are to ensure data security, transparency and openness.

The Mini Survey has been distributed in the form of one-pager aiming to be a direct, personal invitation to everybody to take part in the survey. It worked like a landing page with a call to action button in form of a QR-Code (please see the attachment "D2-2 - Attachment 01 – OSCAR_Mini Survey_Poster_2019-05.pdf").

To promote the Mini Survey to the Aviation sector and make it public, multiple strategies were used. The task seemed to be a challenging one due to the limited time available. To this end:

1. The survey was distributed through the OSCAR partners contact networks.
2. LinkedIn, the professional platform, was used to place the one-pager as a post, which could be liked and/or shared fast and easy.
3. The survey was printed as a hardcopy for being exploited as a take-away information to place at conferences, meetings and other events hosted at research organisations and companies. In this frame, the AEROdays event has been considered as a great opportunity to promote the Mini Survey.
4. The digital one-pager was also published on ARCPORT, a web platform dedicated to the European Aeronautics research.
5. Last but not least, the Mini Survey was published on the OSCAR website and linked to the online content of ARCPORT.

3.1.1.1 Structure of the Mini Survey

The questions of the Mini Survey are given below:

1. How familiar are you with the concept of Open Science?
2. How important is Open Science to your business/organization?
3. How important are contributions to Open Science to your business/organization?
4. Are you familiar with any of the following principles of Open Science? [Open Access, Open Data, Open Peer Review, Open Projects / Citizen Science, Source]
5. What relevance has Open Access to scientific research related to your professional activities?
6. What would you need to make your experiences accessible to the public: Web-Platform, Support, Time, Monetary benefits, Immaterial benefit)
7. Do you have additional comments on Open Science?
8. Personal information (section could be filled voluntarily):
 - 8.1. Gender
 - 8.2. Age
 - 8.3. Country
 - 8.4. Organization Type
 - 8.5. Category of the professional field of activity (e.g. research, industry, administration, etc.).
 - 8.6. Declaration of interest in taking part in a further and more comprehensive survey on the topic of Open Science in aviation
 - 8.7. Any additional suggestions
 - 8.8. Contact data in case the interviewee wants to be contacted by the OSCAR team directly

3.1.2 Activity 2: Big-Survey

The second survey, the Big Survey, was an extended version of the Mini one and included about 30 topics. The relevant one pager distributed to the prospective participants can be found in the attachments (Please refer to "D2-2 - Attachment 02 – OSCAR_Big-Survey_Onepager_2019-12-09.pdf")

The goal was to keep the time allocated for completing the survey to no more than 20 minutes, which is considered to be the maximum survey length for voluntary participation². Yet, non-experienced participants on the topic of Open Science and its concepts might need approximately 30 minutes. The aim of the Big-Survey was to provide an in-depth understanding of the extent of application of Open Science, the perception of its applications and benefits, and to know more about the visions and ideas of people about Open Science in AAT as well as to know what is possible and where the bottlenecks are.

The main topics of the Big Survey were:

1. Which practices of Open Science can provide an advantage for European aviation research and innovation, and how can these best be put in place?
2. Which aspects of Open Science could potentially have a negative impact on excellence and competitiveness of European aviation, and how can this be avoided?

Some representative questions are given below:

- What is needed for users of Open Science?
- What does the user want and expect?
- What does the user accept in rules of accessing Open Science?
- What are the priorities of users?
- What are the must-haves that Open Science works?

Through the results of the Big Survey, it would be possible to use a SWOT-analysis to assess the perspectives of Open Science in AAT. To check out Strengths, Weaknesses, Opportunities and Threats of Open Science in AAT sector. Therefore, the following topics-questions have been included:

- Strengths/High hopes - What will be the best ...to work Open?
- Weaknesses/Risks – What risks do we have to deal with Open Science?
- Opportunities/Options - What can we reach with Open Science?
- Threats/Bottlenecks - Who can take up responsibility?

Therefore, the questions of the Big Survey have been classified and focused to the following four sections

1. Open Science in business
2. Open Science in aviation
3. Open Science Weak Points
4. Open Science in European research

To promote the Big Survey to the Aviation sector and make it public, the following strategies have been exploited:

1. It was distributed through the OSCAR partners contact networks.
2. The AEROdays as well as the Science Slam events (see section □) have been considered as a great opportunity to promote the Big Survey.
3. The invitation for the Big Survey was also published on the ARCPORT platform.

² Revilla M, Ochoa C. Ideal and Maximum Length for a Web Survey. *International Journal of Market Research*. 2017;59(5):557-565. doi:[10.2501/IJMR-2017-039](https://doi.org/10.2501/IJMR-2017-039)

4. Furthermore, a special section dedicated to the OSCAR project as well as to the Big Survey was included into the EASN Newsletter of December 2019, which reaches more than 10 thousand people related to the Aviation sector.
5. The Big Survey was published on the OSCAR website.

3.1.2.1 Structure of the Big-Survey

The extreme challenge with the Big-Survey was to identify the best questions. By assessing the results of the Mini Survey, the points of interest and special focus were revealed.

For the efficient development of the Big Survey and the rest activities, some Open Science definitions made in the frame of the OSCAR project are given below:

Definition 1: Most definitions of Open Science see it as a big variety of digital concepts that are open to be used by public persons. The underlying principle is to share and use information on a free basis, in particular scientific data, knowledge and functionality. Central elements are transparency, reproducibility reusability and open communication. As such, Open Science is part of digitalisation 4.0. And furthermore Open Science is the result to access products/research results of funded investments – a way of Return on Investment for the people.³

Definition 2⁴ – Open Science is an umbrella term which comprises, on the one hand, a specific way of scientific working, and on the other a scientific-political movement. The focus of Open Science is the sustainable openness and accessibility of as many scientific disciplines as possible, for as many people as possible. Important principles of Open Science are freedom and independence of science, transparency, reproducibility, reusability and open communication. There is a close connection between Open Science and digitalisation.⁵⁶⁷⁸

Some concepts of Open Science are for example Open Access, Open Tool, Open Software, Open Citizen Science, Open Notebooks, Open Methodology, etc. The number of concepts is growing as a result of people's ideas for sharing in the World Wide Web.

The survey has been well structured to achieve a feasible maximum survey length in the range of 20 minutes. Answering should be made as easy as possible by selecting one checkbox in a multiple choice system. More familiar participants on the subject would be able to give real own opinions, ideas and impressions in boxes dedicated for comments.

3.1.2.2 Questions of the Big-Survey

In the Big-Survey groups of individual topic areas have been formed. These included the following clusters:

1. Open Science in Aviation.

³ A comprehensive overview can be found at Vicente-Saez, R.; Martinez-Fuentes, C.: „Open Science now: A systematic literature review for an integrated definition“. Journal of Business Research, Volume 88, Pages 428-436, July 2018.

⁴ Translation from the German definition by Martin Spieck. Original text: „Open Science ist ein Sammelbegriff und umfasst zum einen *eine bestimmte Art wissenschaftlich zu arbeiten* und zum anderen *eine wissenschaftspolitische Bewegung*. Im Fokus der Open Science steht die nachhaltige Öffnung möglichst vieler Dimensionen der Wissenschaft für möglichst viele Personen. Wichtige Grundprinzipien der Open Science sind Freiheit, Transparenz, Reproduzierbarkeit, Wiederverwendbarkeit und offene Kommunikation. Open Science und Digitalisierung sind eng miteinander verbunden.“

⁵ Vgl. <https://ag-openscience.de/open-science/>

⁶ Vgl. https://en.wikipedia.org/wiki/Open_science

⁷ Vgl. <https://www.fosteropenscience.eu/content/what-open-science-introduction>

⁸ Vgl. https://www.helmholtz.de/forschung/open_science/

This section includes 5 questions at the current status of Open Science in aviation and air transport.

1. Which applications of Open Science do you know?
2. Which of the following characteristics of aviation are important compared to other industries/research sectors? 1 = very important 5 = none
3. What applications are particularly helpful and/or shall be strengthened for aviation research?
4. The following points were mentioned as being of important for the further progress of Open Science in aviation. What is your opinion? 1 = great relevance 5 = not at all
5. Which principles of Open Science are relevant for your work?

2. Working with Open Science.

This section includes 10 questions covering various aspects that influence how Open Science can be used for AAT research and the benefits that can be achieved

1. How interested are you in getting information or other content from Open Science? 1 = very much 5 = not at all
2. To what extent is it possible today to trust the following content of Open Science? 1 = very trustful 5 = not at all
3. Do you see any problems, ... 1 = very high 5 = none In case you see significant problems you can specify them on the end of the survey.
4. Do you expect to profit from a wider use of Open Science? 1 = very much 5 = not at all
5. How do you use Open Science today?
6. The more controlling of Open Science on quality, the less content will be available. What is more important for you?
7. What level of anonymity would you prefer in order to contribute to Open Science?
8. Retrieval. What kind of system do you prefer? 1 = very important 5 = not required
9. What additional data on Open Science contributions (e.g. publications, test data, procedures) should be made TRACEABLE?
10. How long should information stay available?

3. Open Science in AAT Research.

There are many aspects that influence how Open Science for AAT Research can work. 8 questions shall bring these aspects up.

1. What kind of proof for Open Science documents would be important for you? 1 = very much 5 = not at all
2. Is there a need for access regulations to Open Science?
3. If there is a need for access regulations to Open Science than: How can access regulations to sources look like?
4. If there is a need for access regulations to Open Science, then...: Is there a special way to get permission to access Open Science applications?
5. How trustworthy do you consider information in Open Science when it is published by... 1 = very trustworthy 5 = none at all
6. Is the documentation of Open Science applications to be led by...
7. Responsibility for quality of published data is an issue of ...
8. What additional data on Open Science contribution (e.g. publications, test data, procedures) should be PUBLISHED?

4. Open Science in Europe.

Joint European research in aeronautics and space has proved to be an extraordinary success story in Europe. How can Open Science contribute to the continuation and development of this success story? To develop a picture 9 questions supported the interview.

1. Is it currently possible for you to support quality and behavior in Open Science portals? 1 = very much 5 = not at all
 2. Should Open Science be available in other languages than English?
 3. Which organizations should provide capacity and space for digital content?
 4. Who should compensate the host for making and keeping Open Science data available? 1 = a lot 5 = not at all
 5. What contribution can the European Union do to support and provide Open Science? 1 = a lot 5 = none
 6. What risks do you expect from the implementation of Open Science in the European Union? 1 = very high 5 = none If you have further risk factors to mention, please use our free text at the end of these block questions.
 7. What challenges do you see in the implementations of Open Science in the European Union? 1 = great challenge you expect from the EU to realize Open Science? 1 = very much 5 = not at all, have further expects to mention, please use our free text at the end of these block questions.
5. General information. The general data are for statistical purposes only to help us to better analyze awareness and significance of Open Science in European aeronautics. The information is voluntary. If you do not wish to provide any further information, please click until the end.

See the questionnaire in the "D2-2 Attachment 03 – OSCAR_Big-Survey_2019-09-10.pdf".

3.1.3 Activity 3: Structured Interviews

The third activity has been named Structured Interviews. This activity has been interviews with stakeholders from AAT sector covering a wide range of topics related to Open Science about their views, opinions, experiences and expectations on Open Science. The title "structured" stems from the approach that all interviews shall follow the same structured process as a guiding line while offering the flexibility to set individual spotlights and even deviate from the actual question according to the interviewee's points of interest and areas of in-depth knowledge. Thus, it was possible to cover very specific, individual and detailed aspects of Open Science, while maintaining a consistent overall structure that allows to analyze, compare and evaluate the assembled data.

The intention has been to learn more about the use, habits and options of the different concepts of Open Science in the AAT community and society. Another aspect was to find out the appropriate conditions allowing that research content and processes could be made freely accessible and reusable. The main question that the potential interviewees would be invited to address has been the following: "What is the way and which are the **conditions for exploiting the Open Science principles in the European Aviation research** in favor of Europe in general and the European Aviation in particular?"

In consultation with the OSCAR partners, the stakeholder list was analysed and thus it was determined which people are the candidates, who would possibly give us the deeper insight into aviation. To achieve this, the following criteria were met:

- To select candidates from as many European countries as possible,
- To select representatives from large companies and SMEs, Universities as well as Research Establishments

- To select representatives from different hierarchical levels
- To select candidates covering areas of research, development and production.

The contact list has been created based on the previous activities of this deliverable namely the realization of the Mini Survey and the participation to the AEROdays 2019 and Science Slam. The down-selection of individuals for the list of potential interviewees was done in a consultation process among the OSCAR team. This included the request to all OSCAR team members to propose suitable interview partners, and a multi-criteria screening of the OSCAR contact list developed for deliverable D2.1 "Identification of the spectrum of stakeholders and set-up of communication channels". The underlying objective was to cover, as broadly as possible, the entire AAT community. Accordingly, criteria used were type and size of organisation, field of activity, hierarchical position, organisation's role in the aviation supply chain, country, and level of experience in European AAT research.

3.1.3.1 Structure of the Interviews

The questions for the interviews have been developed by assessing the results from both surveys and the issues that have arisen.

The standard questions on Open Science were kept very short. Concerning the remaining questions, 70 % focussed on WHAT is needed to use Open Science active as well as hopes with Open Science in Aviation, and 30 % focussed on HOW things can work, about ideas and best imaginary future. Differently from the surveys, the questions did not cover any information about the person him-/herself. As all interview partners were selected from a contact list that was compiled from sources like personal recommendations, internet searches and other contact lists of OSCAR partners, the interview team considered the available information about the interviewees' background sufficient and thought it more important to cover as many aspects of Open Science as possible instead.

The structure of the interview aims at offering the interviewee the opportunity to freely respond on the matters of his/her interest, knowledge and experience. For better understanding of the current situation of Open Science, the interviewees are informed with some specific examples provided by the surveys results.

Depending on the interviewee, the interviewer could select the best questions that could be answered, so as to efficiently exploit the knowledge and experience of the interviewee and accurately conclude on the status quo, ideas and visions about Open Science. The answers will be exploited as advice for potential upcoming calls and decisions made by the EU in this field. Through the interviews, OSCAR has achieved to deliver concrete opinions on key issues of representatives coming from many different fields and levels of the AAT Research.

Some characteristic questions of the interviews are presented underneath:

- What opportunities do you see in the implementation of Open Science in AAT?
- What risks do you see in the implementation of Open Science in AAT?
- What personal benefits could you gain from Open Science?
- In principle, Open Science is available worldwide. Is there a need for adequate access arrangements to Open Science?
- Who should get access?
- And how could access to Open Science be organized?
- What kind of content should be protected by access arrangements?
- How can access be organized or managed, and by whom?
- There are severe concerns and even fears of opening up European AAT research worldwide.
- What do you think are the opportunities for European AAT?

- What concerns have to be addressed before increasing the level of Open Science in AAT research?
- The results of our surveys showed that the participants see the responsibility (use, provision of the platform) centrally in the EU. What kind of framework, services and rules could the EU or another entity provide? How could it work?
- How do you see the cooperation and collaboration of the individual EU states with regard to international competition?
- What is the best that can happen with Open Science regarding your professional work?
- What is your high-hope for the development of Open Science in and for Europe?
- Open Science in AAT research: What key message would you like OSCAR to tell the European Commission?
- Different approach to information in RES to IND and SME
- Awareness of actual use of Open Science is low or even denying using it
- It is a difference in funding and investment for the organisation type
- There is a fear of opening worldwide and gaining new profiteers/crawlers
- Ambivalent preference of cooperation versus competitiveness
- Need for access regulations and rules
- Export control of knowledge - legal possibilities and necessities (e.g. export control)
- How to guarantee quality and retrievability of information
- What is the role of the European Commission / European Community
- What about the discrepancy of categorical denying of Open Science and the actual use of Open Science?
- What would be the best use of Open Science?
- What role can established information providers play?
- How perform other branches with Open Science?

3.1.4 Reaching out to the Community: Promotion events

3.1.4.1 AERODays 2019

To draw attention to the Open Science topic as well as to the Mini Survey, the AERODays event which was held in Bucharest, in the Palace of Parliament from 27 until 30 May, 2019 was exploited. AERODays is one of the leading events in aviation research and innovation, mirroring the priorities and strategies set within the European Union Research Framework Programmes. The participants of the AERODays in Bucharest have been of the order of one thousand.

In this context, an OSCAR stand has been set up; it included a poster dedicated to the Mini Survey, which can be seen in the attachments (please see the attachment "D2-2 - Attachment 01 – OSCAR_Mini Survey_Poster_2019-05.pdf"). The visitors of the stand were encouraged to participate in the survey by means of a QR Code or by visiting the OSCAR home page and conducting the Mini Survey at a later time. The participation to the AERODays has offered also the chance to conduct personal interviews and create contacts for the Big-Survey and interviews. Furthermore, through the AERODays event, an efficient dissemination of the OSCAR project has been achieved as well as a contact with all stakeholders of the AAT community.

3.1.4.2 ZAL SCIENCE SLAM 2019

In addition to the AEROdays event, another event before the COVID pandemic that was exploited aiming to foster Open Science to a wide audience as well as to attract people for the Big Survey and eventually for the interviews was the Science Slam. Science Slam is an annual event jointly organized by ZAL, the Center of Applied Aeronautical Research, and Hamburg Aviation and this year it has been attended by about 500 people. In this event, the speakers present their topics as entertaining as possible, yet on scientific basis.

Exploiting this opportunity, the OSCAR project presented the topic of Open Science. The topic has been successfully presented drawing a lot of attention and attracting potential participants for the Big Survey as well as for the following task, the interviews.



Figure 2: Presentation of Open Science at the Science Slam 2019

3.1.4.3 EASN Conference

Due to the COVID pandemic, the physical events were cancelled or postponed. , Hence, the opportunity to exploit physical events for disseminating the OSCAR results and create interactions with stakeholders and thus get feedback on the matters of Open Science in Aeronautics was no longer available. Still, the OSCAR project had the opportunity to participate to the 10th EASN Virtual Conference which took place online between the 2nd and 4th of September 2020. The EASN Conference was dedicated to “Innovation in Aviation & Space to the Satisfaction of the European Citizens”. It proved to be a very successful event with more than 400 participants.

In this frame, the OSCAR project exploited the opportunity and disseminated its main activities with a dedicated session. Furthermore, the OSCAR partners had the chance to interact with stakeholders coming from the field of Aeronautics with a dedicated open virtual workshop on the following issues: “What opportunities do you see in the implementation of Open Science in AAT?” and “What risks do you see in the implementation of Open Science in AAT?”.

4 Results

4.1 Clarifications on the performed surveys

The statistical analysis of both surveys has been performed by using the IBM SPSS® software platform. The input as well as the output files of the statistical analysis in SPSS have been exported to xlsx and docx files, respectively, and they can be found in the attachments. (Please refer to “D2-2 - Attachment 04 – OSCAR_Mini-&Big-Survey_Analysis_SPSS_Input.xlsx” and “D2-2 - Attachment 05 – OSCAR_Mini-&Big-Survey_Analysis_SPSS_Results.docx”)

The request for participation to the Mini Survey has reached a big number of researchers, scientists and managers. A number of more than 160 participants have responded to the survey. This satisfactory number of respondents may be attributed on the one hand to the short time needed to respond to the survey (max 5 minutes) and on the other hand to the successful promotion of the survey at a large physical event, the AERODays (Romania, 2019). The participants to the survey came mainly from France, Romania, Greece and Germany. The strong participation of German and French researchers reflects the dominant role of these countries in Aviation research. The strong participation of Romanian researchers is also understandable as Romanian researchers have been very well represented at the AERODays which took place in Bucharest. The strong representation of Greece is also not surprising as Greece has traditionally a good presence in the European Aviation research with the main Greek participants being from Academia. Noticeable is the limited participation of researchers from Italy, UK, Netherlands and Spain who belong to key players in European Aviation research, although the survey has reached a significant number of researchers from these countries. An explanation might be the limited interest to respond to surveys interpreted by them to rather “political” matters. The majority of the participants (almost 65%) was representing Research Organizations (i.e. Academia and Research Establishments) and about 17% Industry and SMEs. It is worth mentioning that approximately 15% of the participants did not respond to all questions.

Same as with the Mini Survey the request for participation to the Big Survey has reached a big number of researchers and managers. Yet, as the time needed for responding to the Big Survey was of the order of 30 minutes, the response to the Big Survey was smaller and in addition, almost 40% of the participants did not fully complete the questionnaire. About 36% of the participants were representing Research Organizations (i.e. Academia and Research Establishments) and almost 25% Industry and SMEs.

As far as the interviews are concerned, a number of 42 extended and thoroughly designed interviews have been conducted in order to have representatives from all Stakeholders and as many countries as possible. The selected participants have been experienced representatives of the Stakeholders on AAT research whose responses may cover all relevant matters regarding the implementation of Open Science in Aeronautics. The interviewees came from a big number of European countries, namely from France, Germany, Romania, Belgium, Greece, UK, Croatia, Netherlands, Italy Czech Republic, Poland, Portugal and Sweden. Both countries with a stronger involvement as well as less involvement in European Aviation research have been represented. One interviewee has been from Russia. The majority of the interviewees (about 43%) were representing Research Establishments, about 25% were representing Industry (including SMEs) and about 21% of the interviewees were representing University. However, most of the representatives coming from Universities have a dual feature; they are managing research in their capacity as Professors who are heading their research groups and are also performing actively research.

It should be underlined that deriving of statistically reliable results for all European countries and Stakeholders would require for appreciably bigger surveys which would exceed by far the frame and

objectives of the present project. Yet, the achieved good participation to the surveys and the careful choice of a big number of highly experienced interviewees from all Stakeholders led to reliable observations and well justified conclusions.

4.2 Results of the Mini Survey

4.2.1 Key Figures of the Mini Survey

Key figures of the Mini Survey

- **14 easy questions**
- **Time required:** max. 5 minutes
- **Opened:** 20 May, 2019
- **Closed:** 30 June, 2019
- **Participants:** 162
- **Tool:** Limequery / Limesurvey
-

Key facts of the Mini Survey

- **Gender:** 65% male / 20% female
- **Age:** <30 (26%), 31-50 (48%), 51-65 (14%)
- **Organisations:** All Stakeholders (Universities, Research Establishments, Industry including SMEs)
- **Category:** All Stakeholders
- **Professional level:** Scientists, researchers, middle and upper management, engineers
- **Country:** France, Romania, Greece, Germany, Italy, Netherlands, Spain, UK

Organisation Type: About 100 Research organisations participated. It was promoted through the OSCAR partners' networks, AEROdays event, and through the internet platforms ARCPORT® and LinkedIn as well as the OSCAR official website.

4.2.2 Participation in the Mini Survey

Table 1 shows the total number of responses per question of the participants to the Mini Survey.

Participation in the Mini Survey

	N	
	Valid	Missing
ID	162	0
01. How familiar are you with the concept of OPEN SCIENCE?	161	1
02. How important is OPEN SCIENCE to your business/organisation?	162	0
03. How important are contributions to OPEN SCIENCE to your business/organisation?	159	3

04. Are you familiar with any of the following principles of OPEN SCIENCE? [Open Access]	162	0
04. Are you familiar with any of the following principles of OPEN SCIENCE? [Open Data]	162	0
04. Are you familiar with any of the following principles of OPEN SCIENCE? [Open Peer Review]	162	0
04. Are you familiar with any of the following principles of OPEN SCIENCE? [Open Projects / Citizen Science]	162	0
04. Are you familiar with any of the following principles of OPEN SCIENCE? [Open Source]	162	0
05. What relevance has Open Access to scientific research related to your professional activities?	142	20
06. What would you need to make your experiences accessible to the public:	141	21
08. Gender	162	0
09. Age	144	18
10. What country are you from?	159	3
11. Organisation Type	142	20
12. Category	142	20
13. Please select the professional field in which you are active.	142	20

Table 1: Participation in the Mini Survey

4.2.3 Analysis of the results of the Mini Survey

The following graphs analyse the results of the answers provided by the participants in the Mini Survey. It seems that people are mostly familiar with the principles open access, open data and open source, as shown in Figure 3. Figure 4 shows the response of the participants in the frame of the Mini Survey to the question: "What would you need to make your experiences accessible to the public?". According to the participants working in the Research domain, they would need mainly support, time as well as a web platform that they could use to share their results.

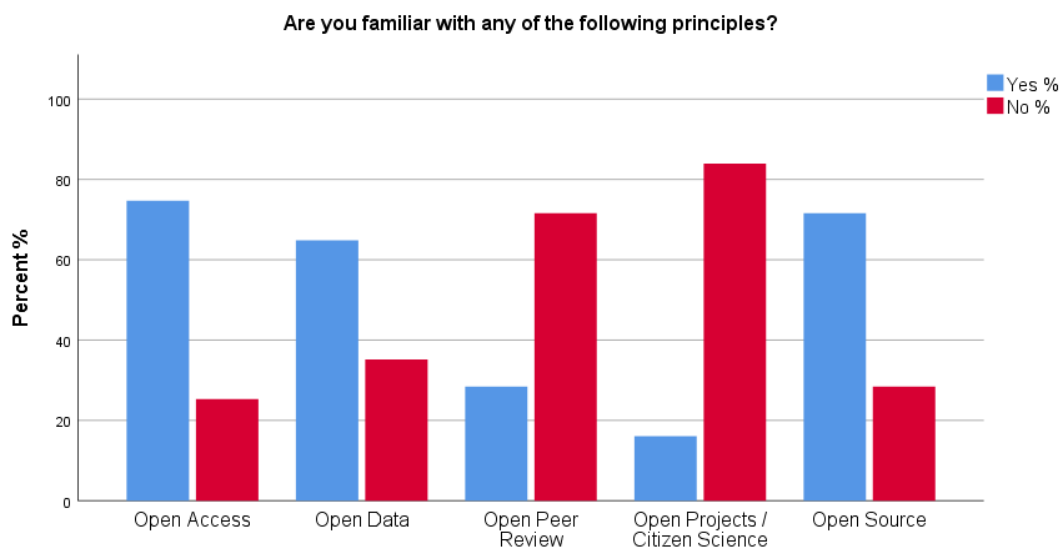


Figure 3: Graph presenting the response of the participants in the Mini Survey on the question: Are you familiar with any of the following principles (open access, open data, open peer review, open projects/citizens science, open source)

What would you need to make your experiences accessible to the public:

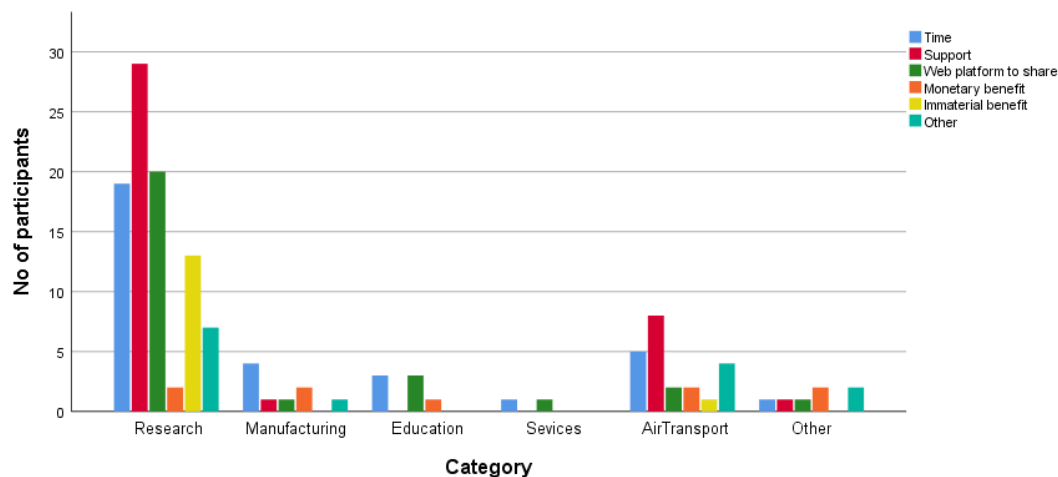


Figure 4: Graph presenting the response of the participants in the Mini Survey on the question: What would you need to make your experiences accessible to the public vs category of the participant (time, support, web platform to share, monetary benefit, immaterial benefit, other)

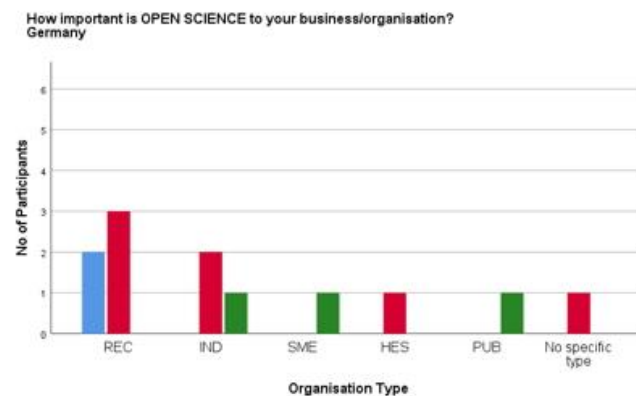
Figure 5 presents the response of the participants in the Mini Survey about the importance of Open Science to the business or organization of the participants and the responses are classified by Organization type and country. Research Organizations and Academia are in favour of implementing Open Science as Open Science is considered to facilitate their research. The industrial sector is more reluctant to proactively support the implementation of Open Science (confidentiality issues, patents, IPR issues, competitiveness, etc.).

For SMEs a high reluctance on implementing Open Science has been observed. This is an understandable result as for this type of Stakeholders their long term financial sustainability relies heavily on retaining and protecting their excellence on a technological niche.

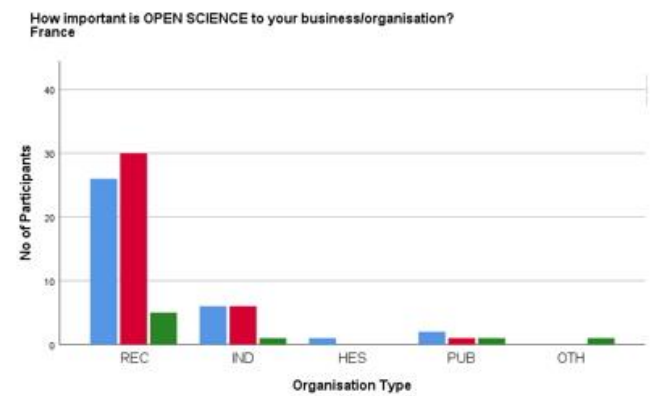
Contributions to Open Science seem to be important for the majority of the participants coming from Research organizations and Industry (Figure 6). Yet a number of participants coming from Industry feel that contributions to Open Science have no significance for them.

All the graphs regarding the results of the Mini Survey are given in the Appendix and the corresponding files are attached (Please see “D2-2 - Attachment 04 – OSCAR_Mini-&-Big-Survey_Analysis_SPSS_Input.xlsx” and “D2-2 - Attachment 05 – OSCAR_Mini-&-Big-Survey_Analysis_SPSS_Results.docx”).

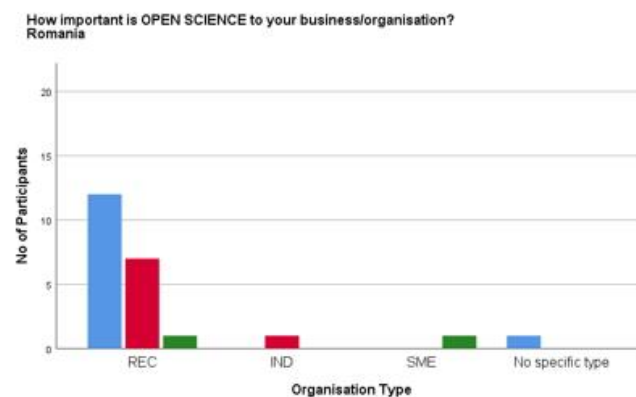
Great Significance
Some Significance
No Significance



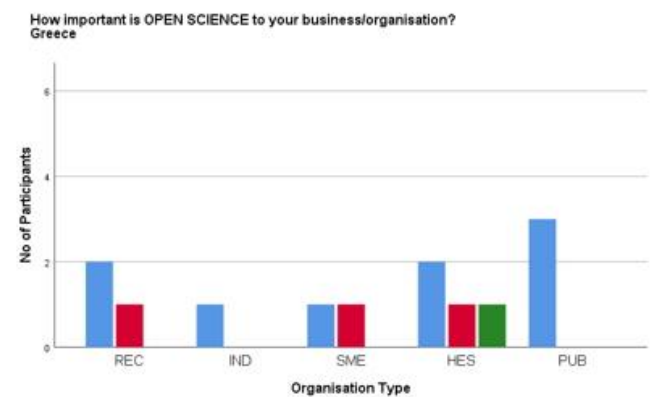
(a)



(b)



(c)



(d)

Figure 5: Graph presenting the response of the participants in the Mini Survey on the question: How important is Open Science to your business/organization (classified by Organization type and country) (REC: Research organization, IND: Industry, SME: Small and Medium Enterprises, HES: Higher or secondary education, PUB: Public body, OTH: Other)

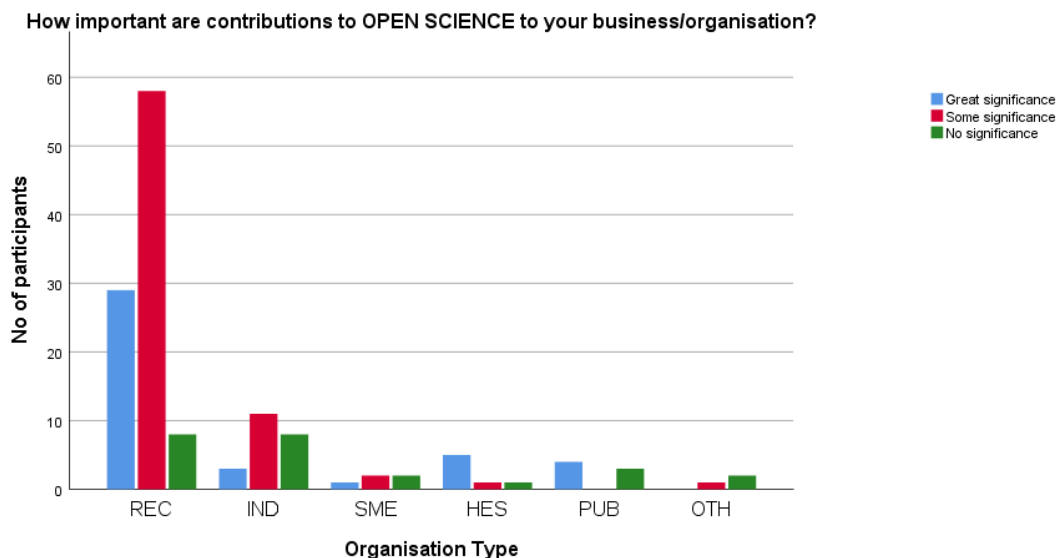


Figure 6: Graph presenting the response of the participants in the Mini Survey on the question: How important are contributions to Open Science to your business/organization vs organization type of the participant (REC: Research organization, IND: Industry, SME: Small and Medium Enterprises, HES: Higher or secondary education, PUB: Public body, OTH: Other)

4.2.4 A quick overview on the result of the Mini Survey

- Open Science is in general perceived to be important to the industry (great / some significance)
- Open Access, Open Source and Open Data are already familiar concepts to the participants of the Mini Survey
- Only 5% of the participants would like to take part also in the Big-Survey and interview final “marketing” attempt (LinkedIn) would be needed.
- Staying in touch with BE OPEN is important to avoid another complementary survey to the AAT community...
- Ca. 40 % of all participants in the survey is familiar with the concept of OPEN SCIENCE
- Terms like Open Peer Review, Open Projects / Citizen Science are not familiar to the participants.
- Time, support and “web platform to share” are primarily necessary to make their experiences available to the public
- Barrier / Challenge: Language!

4.2.5 Characteristic Comments of Participants in the Mini Survey

Characteristic comments of participants in the Mini Survey are given underneath.

- Open Access: Recognition from the academic world since most major publishers are not open access. Open Data: A policy at my institution. No fees required to publish
- Open Science is pushed by Europe without taking into account the bad impact of the unbalanced situation worldwide. Reciprocity is a crucial point for Open Science but this requirement is not taken into account at the appropriate level. Open science will cause harm to

European aerospace and defense research because of the high level of world competitiveness. This survey does not try to have a view on the dangerous aspects of Open Science.

- Open Science should not limit Intellectual Property
- Due to Business competition of major aircraft manufacturer it's important to keep research experience confidential.
- Open-source software is getting integrated in more and more important workflows, but its core still relies on a limited number of contributors. How to encourage and organize contributions is a difficult question.
- Il est inadmissible de faire des sondages qui ne sont pas dans la langue officielle du pays !
- Monetary support to publish my work on open access scientific journals
- In the same way that technology watch takes time to access, understand and sort the data, the sharing of data takes time for industry for providing only relevant data without IP issues.
- Variety and pace of emergence of OA journals makes it difficult to judge credibility, value, and relevance to publish there... at sometimes very high APC costs
- It is necessary to end the domination on the market of the main scientific editors.
- Confidentiality of proprietary data is often an issue.
- Looking forward to a platform to share experiences and create new connections.
- Today, the review process is the only way to have research recognized as secure and sure. The development of many platforms associated to open access papers is a solution to make papers available but it still lacks the need for a full review process before the paper is published. I consider that there is a place for an open-access journal with a full, standard peer-review process driven by the EC. The very same situation could be applied to courses...
- When, as me, you work on military subject, it is always difficult to know what can be classified as OPEN SCIENCE

4.3 Results of the Big-Survey

4.3.1 Key Figures of the Big-Survey

Key figures of the Big Survey

- About 30 topics including a number of question each
- Opened: 01 December, 2019
- Closed: 31 March, 2020
- Time required: around 30 minutes
- Participants: 61 surveys partially and fully answered
- Tool: Limequery / Limesurvey

Key facts of participants

- Gender: 48% male / 8% female
- Age: <30 (5%), 31-50 (21%), 51-65 (26%), >66 (8%)
- Organization: All Stakeholders (Universities, Research Establishments, Industry including SMEs)

- Category: All Stakeholders
- Professional level: Scientists, researchers, middle and upper management

Published on different platforms: OSCAR Website, ARCPORT®, LinkedIn, mailing lists, direct contacts and references.

4.3.2 Results of the Big-Survey

4.3.2.1 Analysis of the results of the Big Survey

According to the results of the Big Survey, people from Research organizations and Industry seem to be interested – to a moderate extent – in getting information or other content from Open Science while the majority of the participants coming from higher or secondary education and SMEs are very interested (Figure 7). Figure 8 shows a graph presenting the response of the participants on the question whether they see any problem by using Open Science results. The results showed that the majority of the participants working as researcher or in the middle and top management see moderate problems, while people working as team or group leaders see high and very high problems.

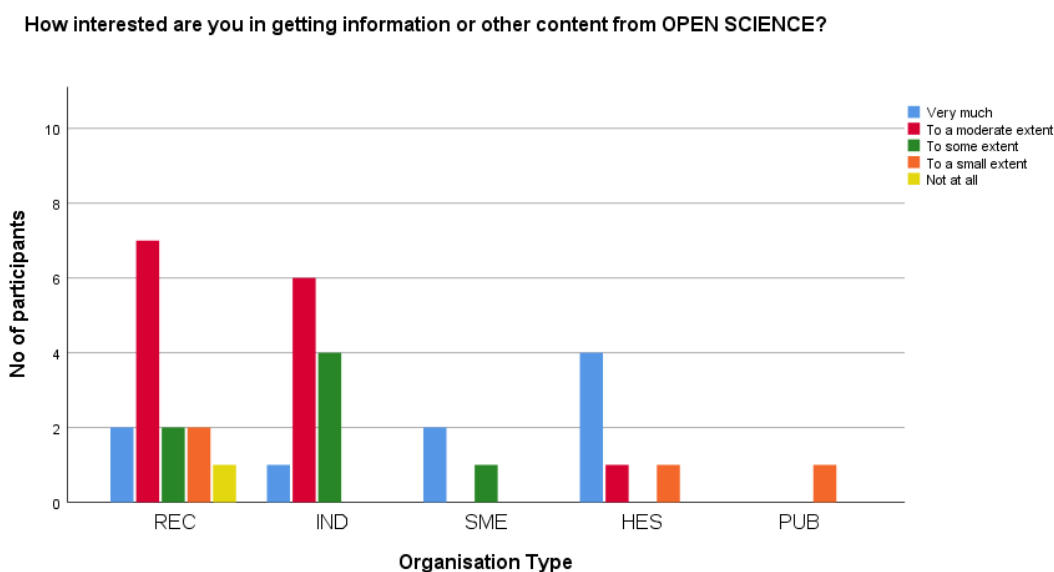


Figure 7: Graph presenting the response of the participants in the Big Survey on the question: How interested are you in getting information or other content from Open Science vs organization type of the participant (REC: Research organization, IND: Industry, SME: Small and Medium Enterprises, HES: Higher or secondary education, PUB: Public body)

Do you see any problem,using OPEN SCIENCE results?

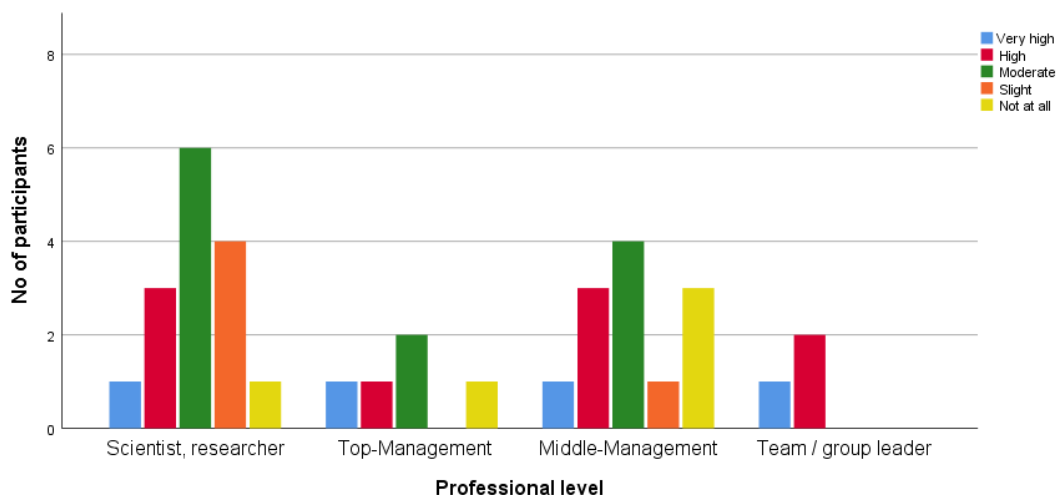


Figure 8: Graph presenting the response of the participants in the Big Survey on the question: Do you see any problem using Open Science results vs professional level (Scientist-researcher, top-management, middle-management, team/group leader)

The majority of the participants considers a low quality of management as a prospective very high risk by the implementation of Open Science, as shown by the graph in Figure 9. Specifically, scientists and researchers are considering the quality of management to be significant and in the case of a low quality management a very high risk, while they consider the loss of excellence and the reduction of competitiveness as a very low risk (Figure 12). On the other side, top management considers the loss of excellence and the reduction of competitiveness as a very important risk (Figure 12). The highest risks for the middle management seem to be data abuse and manipulation. (Figures 10-11). All the graphs regarding the results of the Big Survey are given in the Appendix and the relative files are attached (Please refer to “D2-2 - Attachment 04 – OSCAR_Mini-&-Big-Survey_Analysis_SPSS_Input.xlsx” and “D2-2 - Attachment 05 – OSCAR_Mini-&-Big-Survey_Analysis_SPSS_Results.docx”).

**What risks do you expect from the implementation of OPEN SCIENCE in the European Union?
Quality management**

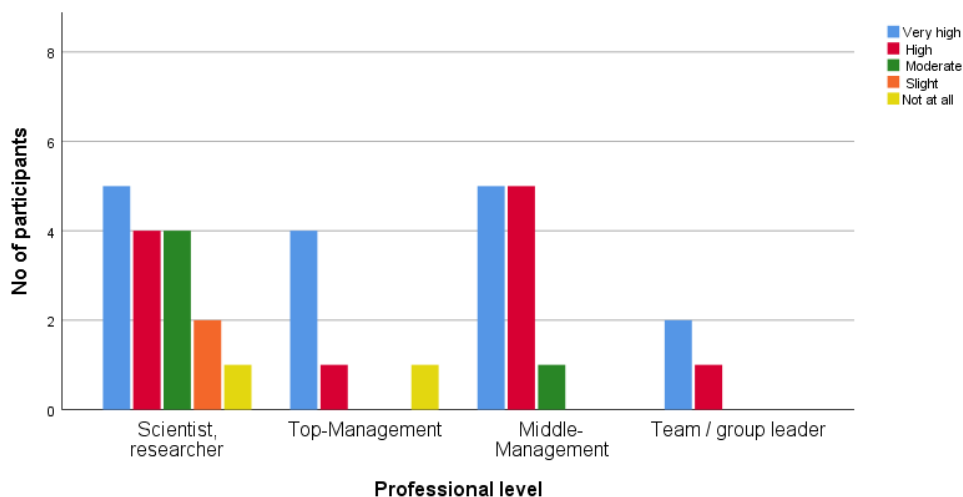


Figure 9: Graph presenting the response of the participants in the Big Survey on the question: What risks do you expect from the implementation of Open Science in the European Union (Quality management) vs professional level (Scientist-researcher, top-management, middle-management, team/group leader)

**What risks do you expect from the implementation of OPEN SCIENCE in the European Union?
Data abuse**

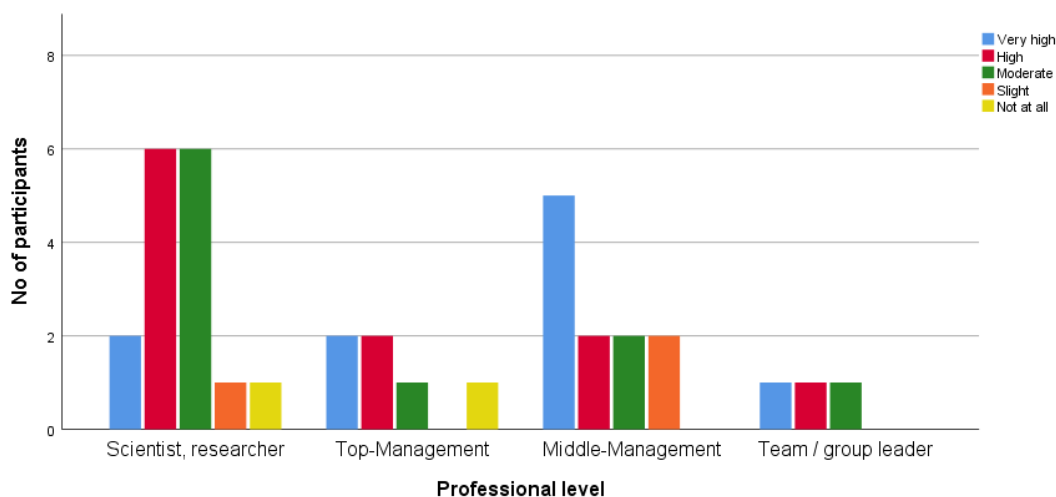


Figure 10: Graph presenting the response of the participants in the Big Survey on the question: What risks do you expect from the implementation of Open Science in the European Union (Data abuse) vs professional level (Scientist-researcher, top-management, middle-management, team/group leader)

What risks do you expect from the implementation of OPEN SCIENCE in the European Union?
Manipulation & hacking

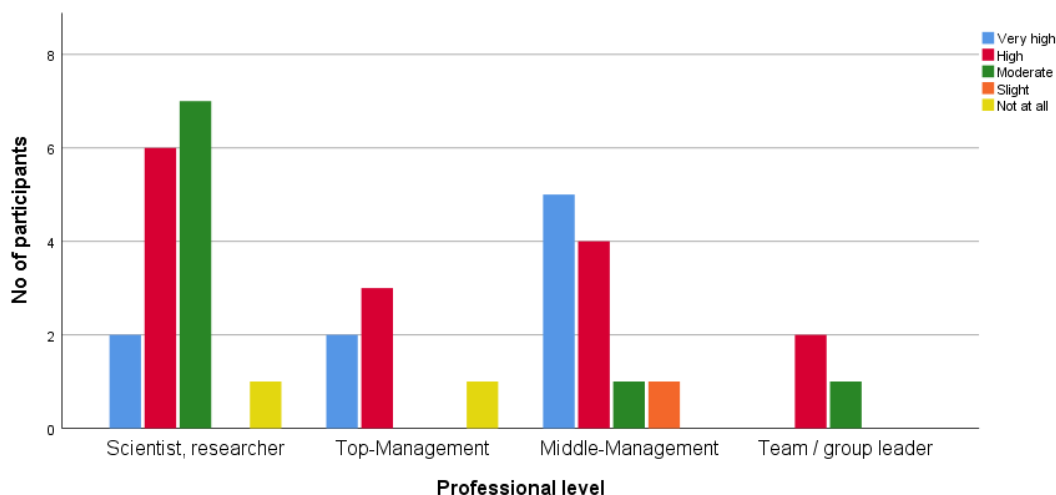


Figure 11: Graph presenting the response of the participants in the Big Survey on the question: What risks do you expect from the implementation of Open Science in the European Union (Manipulation & hacking) vs professional level (Scientist-researcher, top-management, middle-management, team/group leader)

What risks do you expect from the implementation of OPEN SCIENCE in the European Union?
Loss of excellence / competitiveness

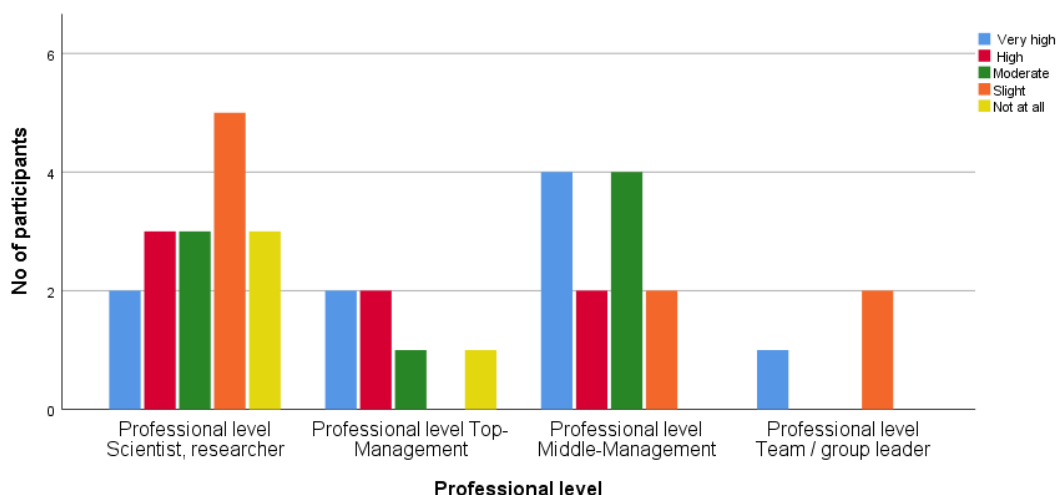


Figure 12: Graph presenting the response of the participants in the Big Survey on the question: What risks do you expect from the implementation of Open Science in the European Union (Loss of excellence/competitiveness) vs professional level (Scientist-researcher, top-management, middle-management, team/group leader)

Figure 13 is presenting the responses of the participants on the question “What challenges do you see in the implementation of Open Science in the European Union?”. Participants are considering the Protection of Intellectual Property and Competition as the most challenging issues with regard to Open Science.

What challenges do you see in the implementations of OPEN SCIENCE in the European Union?

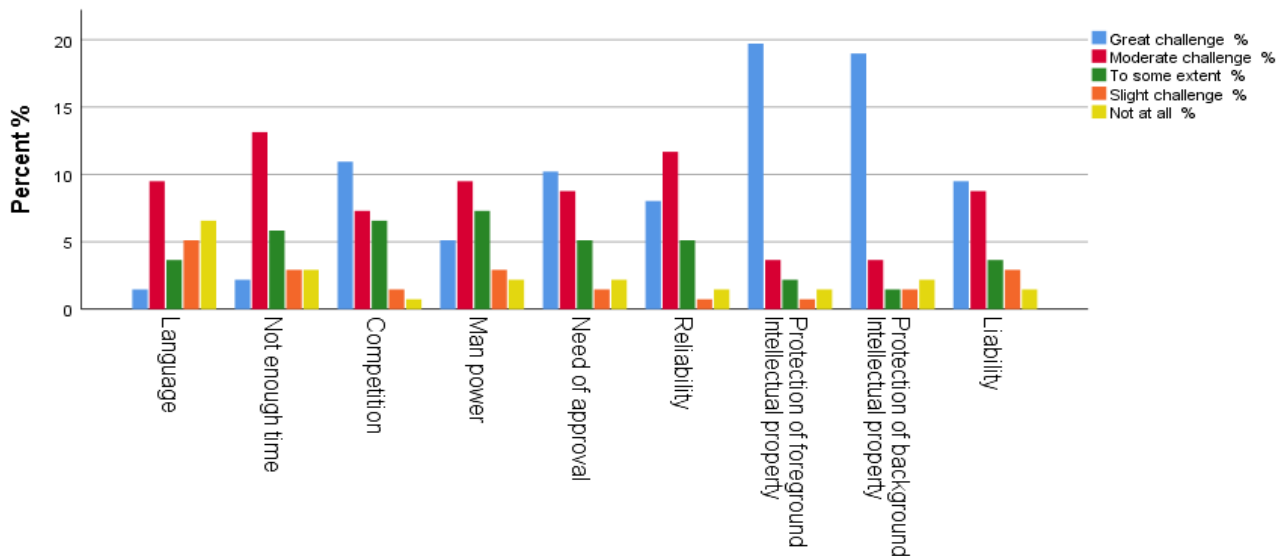


Figure 13: Graph presenting the response of the participants in the Big Survey on the question: What challenges do you see in the implementation of Open Science in the European Union.

4.4 Results of the Interviews

Although the availability of the interviewees was limited by the Covid-19 pandemic and the summer / vacation time, more than 80 stakeholders could be reached and a big number of interviews has been conducted. Tables 2-3 provide the professional level as well as the organization type of the interviewees. Due to the restrictions and impact of the Covid-19-crisis, the interviews have been virtually conducted after the interviewees have given their consent to the General Data Protection Regulation (see attached file: "D2-2 – Attachment 06 – OSCAR_Interview_GDPR_2020-07-13.pdf"). A representative info pack sent to the prospective interviewees might be seen in the attachments (Please refer to "D2-2 - Attachment 07 – OSCAR_Interview_Infopack_OPEN SCIENCE.pdf").

The results shall feed into a research outcome that will provide an input to the EU policies, on why and how concepts of Open Science should and will be implemented in the upcoming framework programme "Horizon Europe".

Key figures of the Interviews

Number of interviews: 42

Gender: 81% male / 19% female

Period: 01.08.2020 – 30.09.2020

Countries: Germany, France, UK, Swiss, Romania, Greece, Portugal, Poland, Italy, Czech Republic, Sweden, Croatia, Belgium, Russia, n/a

Organisation Type: Research, Industry, Higher Education

Professional Field: Mostly management

Hierarchy

Invitation

Interview

n/a	14	7
Administrative	2	1
Management	42	21
Public	1	0
Scientist	13	5
Senior Expert	1	1
Top management	12	7
Total	85	42

Table 2: Professional level of the interviewees

Organisation Type	Invitation	Interview
HES	14	10
IND	28	12
OTH	5	1
PUB	4	0
RES	31	17
n/a	3	2
Total	85	42

Table 3: Organization type of the interviewees

4.4.1 Interesting points-of-view

The following sections highlight some answers which were received during the interviews. They are listed because they either touch a point of common interest or concern among many participants, provide a new point-of-view, or demonstrate that there are conflicting opinions in the AAT community.

4.4.1.1 Optimism

"Open Science is about **working together across „boundaries“** to solve a problem that cannot be solved alone (i.e. not by an individual, a research department, an organization), but need input in the form of knowledge, ideas and work from different areas and/or sources."

"Open Science is basically random and not standardized, but **its importance is overwhelming**. It boosts all projects from a very early stage. It is always easier to do interactive meetings in early project phases and rely on Open Science resources like applets or just pdf files (papers or presentations)."

"Free compilers, free CAD software, computing tools, numerical routines are part of the infrastructure of Open Science and provide serious industrial support. **Any future without them is impossible to be imagined.**"

4.4.1.2 Pessimism

"Manufacturers are constantly adjusting how much know-how they have to open up so to maintain the competitive edge on one hand, and be customer-focused on the other. **Open Science will not change the way this is being handled**, as stakes are too high."

"AAT research is often focused on applications (applied research), therefore it can be close to industrial development with **associated confidentiality issues**. Furthermore, aeronautics is strategic for some nations, thus limiting the concept of Open Science."

"Open Science will put those with advanced know-how at disadvantage. Other, less advanced players will be able to catch up quickly. **This hurts innovative organizations.**"

"Open Science **benefits only big players** who have already invested in Big Data and AI, giving them a competitive advantage over smaller or emerging players."

4.4.1.3 Access & confidentiality

"The conflict between openness for dynamic progress and protection of vital interests is **difficult to solve**. No idea how..."

"**Access to Open Science cannot be securely regulated**. Once information and know-how can be accessed by European stakeholders, every professional player in the world who is really interested will be able to get it one way or another."

"The problem with more Open Science is in **particular with the USA**. Nobody expects a fair & balanced exchange of know-how with China, who are as protective. And history shows that reasonable scientific/technical interaction with Russia can be arranged on a case-to-case basis. But scientific „exchange“ with USA has been a one-way street at all times (not only since Trump). Strangely, European researchers have been enthusiastic about sharing their results with the USA, and still continue to do so."

4.4.1.4 Disruption & breakthrough innovation

"The existing network landscape in AAT leads to a very efficient „more-of-the-same“ research: excellent incremental, mono-disciplinary optimizations of existing technology, **but little else**."

"Open Science is one of the **hopes to achieve disruptive and/or large-leap** evolutionary concepts towards „zero-emission aviation“."

"**Open Science needs incentives** so that really disruptive, holistic ideas are being rewarded. A possible mechanism could be similar to venture capital. As aviation is not attractive for VCs (high investments, high risks, many regulations, products not scalable which limits the possible ROI), the concept would have to be adapted to AAT. "

"The EC could play a vital role in it: not to fully finance an innovative product like VCs, but to fund enough to get innovative concept over the first „valley of death“ between a preliminary study and a more thorough analysis and development of the necessary (underlying) knowledge."

4.4.2 Summary of the Interviews results

The following sections 4.3.2.1 – 4.3.2.6 summarize the main points from the interviews results divided in subsections according to the subject matter.

4.4.2.1 Opportunities by the implementation of Open Science in aviation research

The implementation of Open Science may pave the way for faster progress and innovation in AAT research landscape. Open Science is one of the hopes to achieve the goals set by EU for zero-emission aviation.

- Open Science will allow better dissemination of the information and collaboration between the disciplines, as well as to break the up to now barriers and constraints.
- Funded by EU research, European citizens should be able to benefit from it. People should see tangible benefits of the funding from government agencies.
- Great opportunities for Green aviation technologies as it will be of worldwide interest to share such knowledge. The results will also benefit Europeans.
- Eliminating double efforts. Further development of the already gained knowledge.
- Not highly developed countries in Europe will have the opportunity to exploit the open research in the field of Aeronautics.
- Open access to seriously peer-reviewed journals is a great benefit.
- Open Science can raise awareness and visibility on research results and thus to researchers.
- Better, updated and more valuable information for researchers.
- More dynamic and faster development and efficient implementation of research results.
- Resources and cost optimization, as well as faster development cycles.

- Opportunities for international cooperation.
- Free or low cost access in publications and in other's people research work.
- Promotion of young scientists.

4.4.2.2 Possible risks by the implementation of Open Science in aviation research

- IPR issues, confidentiality issues, security issues, technological spying, control flow of information, misuse of data.
- If we deliver the knowledge to the areas we compete with other "partners" outside of the Europe sometimes they can use it against us.
- AAT is a high tech sector with high and long-lasting investment costs. Thus, the technological achievements lead to a competitiveness advantage against competitors in the civil and military aviation market. This causes a high reluctance of industrial stakeholders to be willing to do Open Science. Furthermore, AAT research is often focused on high TRL applications with associated confidentiality issues. Openness in higher TRLs is very difficult. In the case that Industry has financially contributed, the level of openness is appreciably decreased.
- Military aviation uses technologies and principles that can be the same with the ones of civil aviation. This involves further risks.
- Open Science might become a victim of economic interests.
- The quality of a number of open access journals is questionable. Scientists are sceptical about the quality and the reliability of the content in open access journals, open data, open source, etc. There is the need to ensure the high quality and the reliability of the Open Science content. A strong peer review system by a scientific advisory board adopted as a standard practice for open access journals, open data, open sources, etc. would appreciably increase the trustworthiness of Open Science content. On the other hand, being open means that something is also open to criticism and to many reviewers which in turn may increase its quality.

4.4.2.3 Working with Open Science: Perception of the already developed platforms and content

- Open Science has already benefited people in general domains (e.g. Youtube, Linux, Wikipedia, etc.) as well as in AAT sector (e.g. OpenFOAM, etc.).
- The already gained benefits from Open Science could act to promote the establishment and implementation of Open Science.
- Article Processing Charges are inappropriately high in many cases.

4.4.2.4 Understanding the differences between industry and research with regard to Open Science

- SMEs that have limited budget for R&D can significantly benefit from Open Science by further developing a research work which can be at TRL 3-4. On the other side, SMEs might lose their strategic advantages by big industries that may gain even more influence by the implementation of Open Science.
- The implementation of Open Science and thus the opening of all information might lead in a reduction of the participation of industrial partners.
- Fundamental science at lower TRL can be open to all. Low TRL implies to open access, medium or high TRL are not very convenient for open access because companies may lose their strategic advantages.
- For example the methodologies for a wind tunnel test would be a benefit for the market community but sharing wind tunnel data on a specific model or sharing data on a future aircraft which performance can be derived, our experiences show that creates sensitivity.

- Another example is flutter analysis. Having skilled people to do flutter analysis for small aircrafts, such knowledge and know-how is for big money value and creates a strategic advantage against competitors.
- A certain number of source codes are in Open Source, yet source codes used by industrials are not in Open Source - there is a key know-how.
- Main competitors of European AAT is China and USA. The aeronautics and air transport sector is doing well in Europe; caution is needed to maintain our advantages against competitors.

4.4.2.5 Infrastructure and facilities for the implementation of Open Science

- A concrete framework handling all related issues should be developed to implement Open Science.
- There is the question about who will pay for the data hosting.
- Open data seems of crucial importance for re-exploitation in the framework of other projects. Therefore ensuring F.A.I.R. data is a must. However, the unconditional availability of open data might involves risks in terms of competitiveness, a limitation which may be underestimated by the European Commission.
- European Commission should coordinate the related activities.
- A large amount of information can be handled by using the approach of Big Data.
- There is a need for a legal/regulatory/consent-driven framework for OS that provides guidance, support and legal protection.
- Open Science infrastructure: platforms / databases for Open Science, tools for searching, retrieving, storing information, etc. A tool to verify the registered person. A good template could be e.g. CORDIS, ResearchGate, etc. Peer review has to be ensured.
- Either Open Science framework can be run by a professional company or by using the existing services (e.g. European Union and the Office des Publications de l'Union Européenne in Luxemburg, etc.)
- How to open up in certain directions of the world and control the flow? How do you limit access? The flow of the information cannot be always controlled as a lot of non-European companies have their representatives or subsidiary companies also in Europe.
- Worldwide Open Science should be developed on the basis of reciprocity so as to have a fair and balanced information exchange.
- The implementation of Open Science could be done in different levels. Basic science could at TRL 1-3 could be available for all, TRL 4-6, applied research at TRL 7-9 could be restricted under specific requirements. Another criterion for the classification could be the age of the information. For example old technologies could be directly accessed (e. NASA technical reports).

4.4.2.6 High-hopes for the implementation of Open Science in the future

- The implementation of Open Science may pave the way for faster progress and innovation in AAT research landscape. Open Science is one of the hopes to achieve the goals set by EU for zero-emission aviation.
- There must be a balance of how much open and how much restricted should be Open Science.

4.4.3 The Take-Away

Drawbacks

- More work, no support by management
- Open Science landscape is too heterogeneous to be efficient and fun to work with.
- Quality of content varies, cannot be depended on
- Access cannot be reasonably regulated (e.g. restricted to European orgs who also contribute)

Chances

- Making research better: more dynamic, efficient, interdisciplinary, disruptive,...
- State-of-the-art is easier to access: better for education, finding niches and open challenges,...
- Becoming more attractive for the "best & brightest" talents in a world of increasing barriers

Fears

- Losing the grip of one's Intellectual Property:
as a company (loss of competitiveness) and
as a scientist (loss of reputation)
- Approach of EU will be too rigid, demanding, regulated, unbalanced and underfinanced to unlock the potential of Open Science

Hopes

- Open Science can be the driver to really address the enormous challenges aviation is facing
- Strengthening reason-based cooperation again across the frontiers which are being erected today
- Key to master the transition to a digital and greener society in Europe

5 Conclusions

5.1 Contribution to the Project

The work performed in T2.2 and documented in this deliverable, including the attached files and data bases, provides a base for the activities performed in WP2 work packages WP3 to WP5.

In particular, it assembled views, opinions, experiences and other insights from the AAT community with the objective to:

- gain a significant and, to a certain extent representative status of the current situation in AAT research,
- provide an outlook on possibilities how to enhance the use and exploitation of Open Science, and...
- feed the other work packages of OSCAR with information and analysis results that are tailored to improve the impact of their activities.

5.2 Conclusion, Preliminary Findings and Remarks

5.2.1 Conclusion from the Mini Survey

The results show that Open Science already has significance for employees and companies and is being expanded. It is interesting to note that Open Access, Open Source and Open Data are already well-known concepts that are being applied. About 40 % of the participants are familiar with the concept of Open Science. Free access is welcomed, fee-based access is rather rejected. Open Peer Review, Open Projects / Civic Science are little or not known at all. This shows that the public relations work regarding the "courage of all" of Open Science has not yet been effective. Open Science is more than "Open Science". Open Science includes many areas that are not yet known by the participants. Language is seen as a barrier or challenge. Many countries accept or prefer English as the basic language of science, some wish to use their mother language.

All participants are convinced that time, support (personnel as well as financial) and a central web platform are necessary to make experiences accessible to the public.

Through the Mini Survey, 5% of the participants have been gained for participating in the Big-Survey and the interviews campaign. They were willing to share their experiences, criticism and hopes with the OSCAR team.

5.2.2 Conclusion from the Big-Survey

The results of the Big-Survey are in principle confirming the results of the Mini Survey and providing more detailed and in-depth views thus allowing for more solid and specific conclusions. Open Science is already important for participants and companies. It can also be confirmed that Open Access, Open Source, Open Data and Open Software are already known. On the other hand, terms like Open Peer Review, Open Tool, Open Projects / Civic Science or relevant concepts are not familiar to this group of participants either.

Time, support (personnel and financial) and a central "web platform for exchange" are necessary to make the experiences available to the public. After seeing the language barrier in the Mini Survey, the majority of participants in the Big-Survey agreed that the language "English" is sufficient for the communication in science and technology matters.

Furthermore, the participants wish that the data or information provided are reliable. Here a quality stamp could be inserted, which should satisfy certain criteria e.g. accuracy, completeness, consistency, relevance, timeliness, etc. Besides the quality of the documents, the unlimited availability of the documents or information is also desired. Thus, knowledge gained "in the past" can be accessed or picked up.

There is the need for an access regulation to Open Science in the AAT. This can be regulated in the form of e.g. "PIC Codes" or passports.

It could be identified that technological requirements and upfront investments are the most important characteristics of other industries / research sectors. This distinguishes AAT from other industries.

The wish of the participants is that all applications of Open Science for aeronautics research are particularly helpful and/or should be strengthened. It is interesting that Open Science is considered important in the AAT, but is also viewed very critically. Here, keywords such as "data misuse" or "theft" have been mentioned across the EU. Currently, the participants are mainly interested in receiving information or other content from Open Science. Greater concerns when they use or publish information from Open Science are minor. The expectation is high that the information provided will have a broad benefit.

Although interest in information is high, the use/publishing/retrieving of information from Open Science is not yet used very intensively. Possibly a main obstacle is the lack of a central cross-industrial, web platform. Currently, publications are available e.g. on the websites of universities or paid providers per category. This wide range of web platforms is time-consuming and deterrent.

The participants agree that the date of publication, the name of the author, the company, the organization, the institute, customer rating of Open Science contributions must be made traceable. It is unacceptable to have an avatar and anonymity when publishing Open Science publications, as these do not appear trustworthy.

Participants consider information from Open Science trustworthy if it is reviewed and published by a central EU agency or authority.

Responsibility for the quality of published data lies with the publisher (yes); portal / source (shared); user (no - shared). In contrast, reviews, articles and publications, activity status, rating can positively support the quality and behavior in Open Science portals.

The participants expect the greatest risks in the implementation of Open Science in the EU to arise from manipulation & hacking, quality management and data misuse.

The background "protection of the new intellectual property / protection of intellectual property" is seen as the greatest challenge in the implementation of Open Science in the EU.

The participants also agree on the provision of capacities and space for digital content: the EU, public research and the state government should provide capacities and space for digital content.

The participants also expect the EU to raise the following points for the implementation of Open Science in the EU: support, guideline / standards and money.

5.2.3 Conclusions from the Structured Interviews

5.2.3.1 The Future of Open Science

The following section comprises the "Future of Open Science" in AAT research & innovation" as seen by the interviewees.

- **Fairplay**
Open Science means to „Give & Take“. Balanced and fair cooperation is essential.
- **Level playing field**
Every participant of (and contributor to) Open Science should be able to reap his advantages. No „bonus“ for large and influential players, aggressive parasites or protective countries.
- **Differentiated levels of Open Science**

The level of „openness“ (and consequently the approach and content) has to be adjusted to the scientific/technological application.

The higher the TRL and the lower the public funding, the less open Open Science can be.

- **Easy access to „Open AAT Science“**

Open Science content for aviation & air transport should have a central access point and a logical structure – e.g. via an overarching meta-tool.

Open Science contributions from EC-funded projects could lay the foundation for this.

- **The perceived dilemma of „speed“ vs. „power“**

The advantage of Open Science is its dynamics. Quality can only be supported by „evolutionary maturing “: Good content survives, bad content vanishes.

Open Science cannot replace the current scientific system – it shall complement it with a more dynamic, rapidly moving dimension.

- **Supporting the “right topics” for Open Science**

- Basic research: new concepts, general methods & principles
- Reference data & models: comparison, calibration
- Common standards: everyone is more efficient (suitable even for fierce competitors)
- Teaching material: higher education and professional training

- **Addressing the big challenges of aviation**

Open Science is an enabler for reconciling mobility & climate change – or at least it can be the “game changer” if done right in Horizon Europe.

This requires a truly cross-cutting approach across disciplines: aviation, fundamental physics & chemistry, chemical engineering, social sciences, cybernetics (biological & engineering), etc.

- And it has to be done in a better (more dynamic, integrative, holistic) processes of research.

5.3 Lessons learned

By submitting the OSCAR proposal one of the main assumptions made has been that «Experience shows that higher TRL usually goes with more strict protection of Intellectual Property Rights (IPR) which contradicts the concept of Open Science. However, IPR protection is a central pillar of competitiveness. Hence, implementation of Open Science requires a transparent trade-off with IPR requirements».

The results of the surveys and interviews have confirmed this assumption. Indeed, when research results are reaching high TRL levels (TRL>6) the implementation of Open Science becomes more difficult as it may be related to confidentiality issues, patents, IPR issues, etc.

Furthermore the results of the surveys and interviews with experienced stakeholders have revealed that both, the researchers as well as the management of Research Establishments and Academia from developed countries e.g. France, Germany, etc. are in favour of implementing Open Science as it is considered to facilitate their research through the accessibility to results and data obtained by other researchers as well as to facilitate the publication of the results obtained through their own research. In countries where research is mainly performed by Academia and linked rather to the big European industrial players than to the limited local Industry (e.g. Greece) Open Science is also very well accepted and much appreciated. Furthermore, as expected, Open Science seems to be very

important for the Research Organizations and Academia from countries advancing well with their Aviation research efforts (e.g. Romania.)

On the other side, as expected, the industrial sector of the developed countries is more reluctant to proactively support the implementation of Open Science due to the reasons mentioned above (confidentiality issues, patents, IPR issues, competitiveness, etc.) and further efforts as well as appropriate clarifications, tools and political arrangements would be needed for convincing them for the benefits of implementing Open Science.

Furthermore, for SMEs a high reluctance of implementing Open Science has been observed. This is an understandable result as for this type of Stakeholders their long term financial sustainability relies heavily on retaining and protecting their excellence on a technological niche.

Finally it should be mentioned that the majority of scientists and researchers are interested on exploiting information, data or other content taken from Open Science sources yet in several cases they are encountering problems to exploit Open Science for publishing their own research results. To these problems belong the high publication fees applied by reliable Journals of high quality, the reluctance of the middle-management of industry to endorse the Open publication of results, etc.

It is worth mentioning that the type of entity where a researcher is employed (i.e. University, Research Establishment, big Industry, SME) has more influence on her/his perception of Open Science as well as her/his willingness of exploiting the opportunities offered by Open Science than the Region or Country where the researcher is active.

Yet, the major challenges in the implementation of Open Science in Europe are remaining the protection of background and foreground Intellectual Property and the understandable need for Competitiveness.

5.4 Results from D2.1

Additionally to the direct results achieved by this work, as listed above as contributions to the project, the following points are notable:

- In the landscape of European AAT research, all conceivable interest groups have their dedicated representation – except SMEs (small & medium enterprises). This is not due to a lack of effort. There were various initiatives, by the Commission as well as independent, to create a European SME representation, but none of these proved to be permanent or sustainable.

The best voice SMEs currently have in the European RTD arena appears to be through their local (national or regional) clusters, respectively the clusters' European partnership EACP.

- The suitable internet presences of the European Union (EU website at ec.europa.eu), respectively of the European Commission (CORDIS - Community Research and Development Information Service), apparently do not explicitly support the dissemination and exploitation of Open Science achievements from EC-funded projects.

In the analysis performed for this deliverable, it was attempted to find known Open Science content from completed FP7 and H2020 projects via those portals. Even for projects which had been particularly acknowledged and praised for their valuable free and open contributions to aviation research, no reference could be found in these repositories.

- The environment of Open Science, and its various principles and “flavours”, is highly dynamic, and may significantly change within months. This adds another aspect, or dimension, to this project which was not regarded that dominant prior to this analysis: time.

The subsequent activities of OSCAR will now take this aspect into consideration.

- The dynamics of the development in Open Science is aggravated by the most popular approach of most users to research the Open Science landscape: internet search. Most search engines deliver their results according to a very complex (and non-transparent) set of internal criteria, including location of the user and his/her type of internet access, type and model of hardware, operating system, installed browser, stored cookies and browser history, and many more.

Care was taken in the analyses which included internet searches that all queries were made in the same configuration, such as internet access point, hardware, empty browser cache, etc. Of course, other aspects which are beyond the control of the user, such as changes to the internal search engine criteria, could not be precluded. Comparison with internet searches on other topics, which were made as a test to determine the latter influence, proved to deliver much more stable and consistent results. This allows to conclude that it is in fact mainly the Open Science arena which is so dynamic.

Additionally, this aspect underlines the necessity of a broad and consistent approach and a stable access to Open Science. It is hard to image how professional collaboration in Open Science-enabled AAT research is possible if each researcher sees a completely different landscape when navigating through the world of Open Science, depending on where, when and how he or she is online.

- There is an impressive number of Open Science platforms, data bases and comparable portals, gateways and archives available and accessible. Some of them attempt to cover Open Science as broad and general as possible with the ambition to have “something on everything”, while others carve out a very specific and focuses niche, targeting the “everything on something” approach.

Both approaches have their own advantages and disadvantages, and as far as it can be seen at this point in time, aviation research will need both. (The perception and opinion of users from all areas of the AAT community will be covered in detail in the “Big-Survey” and the Structured Interviews to be conducted later in WP 2.).

However, the sheer number of access points and the lack of interlinkage, connectivity and continuity leads to a very fractured and heterogeneous environment, which impairs efficiency and raises doubts if valuable contributions to Open Science really receive the attention they deserve. If Open Science is to play a vital role in future European research, it appears reasonable that a balanced and sustainable concept is found to allow easy and efficient access to both, breadth and depth of knowledge.

5.5 FAQ on OPEN SCIENCE

Issues to make science accessible to the public and beneficial to industry and the public.

How do you gain a competitive advantage through OPEN SCIENCE?

- Regional, National, Europe, Worldwide

Where and how is information collected?

- Centralized vs. decentralized?
- Who organises this?
- Who bundles the data?
- Who pays for the collection and the organisation?
- Who can contribute?

- How is data protection ensured?

5.5.1 Expected impacts of BE OPEN

Parallel to OSCAR a complementary project, namely the BE OPEN project is running. A close cooperation between the two projects has been established in order to maximize their synergies. For the convenience of the readers the impacts expected by BE OPEN are summarized underneath:

- Develop **governance and new operational/business models** for enhancing Open Science by describing the rationale of how to create and capture value in economic and social context
- Develop the **European Code of Conduct on Open Science in transport** proposing recommendations and proper guidelines that allow setting up a community of transport research organizations
- Create **awareness and visibility** in particular towards the transport research Community but also the authorities, Industrial and SMEs, Associations in Transport, Publishing Companies, the various European Technology Platforms, and pursue strong media coverage
- Engage **international stakeholders** in mutual learning and sharing experiences
- Implement the **TOPOS forum and observatory** tools to contribute to create a **solid knowledge base on the implementation of Open Science** approach in transport research

The overall BE OPEN methodology follows a systematic implementation solution that depicts the different activities to be implemented for fostering Open Science in transport research as well as the interrelations among them

BE OPEN Leaflet

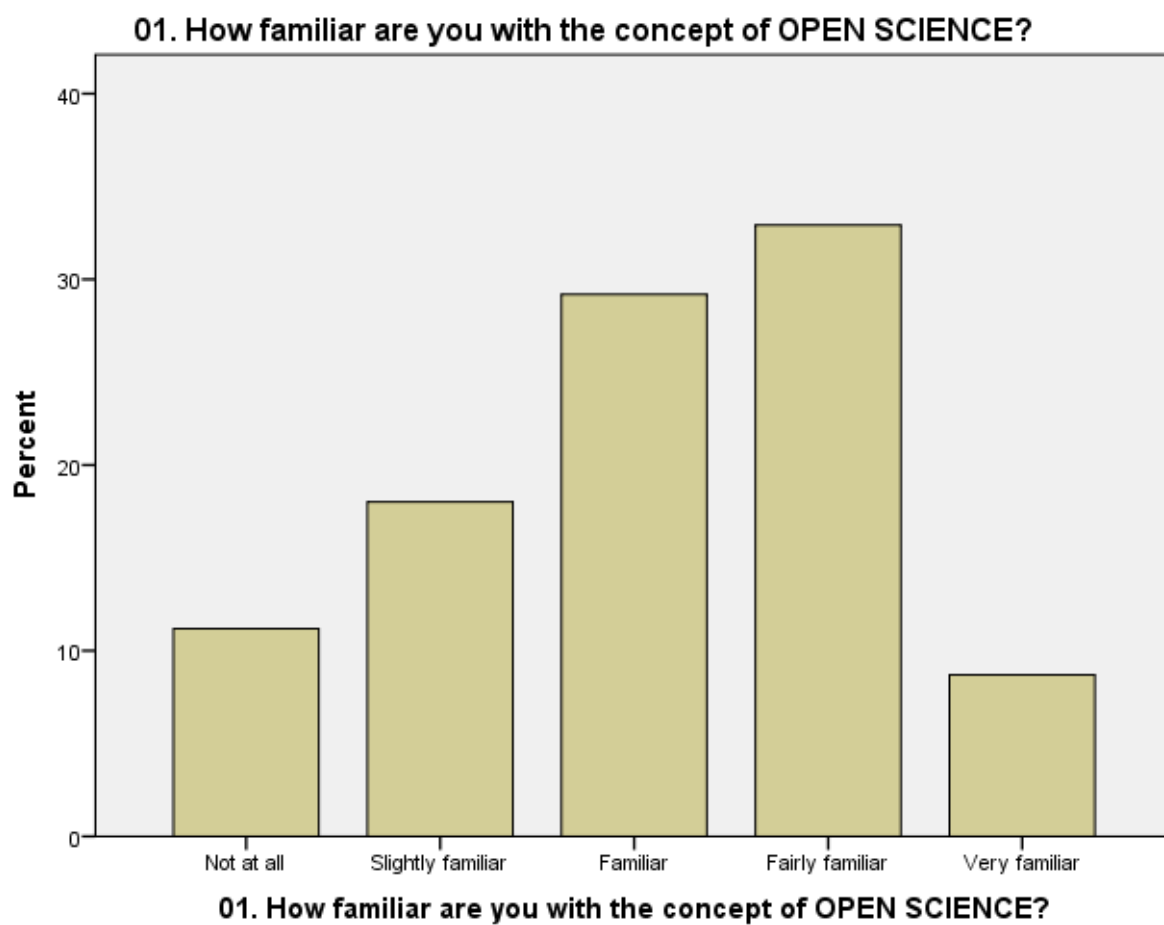
Link: <https://beopen-project.eu/resources/leafletAppendix>

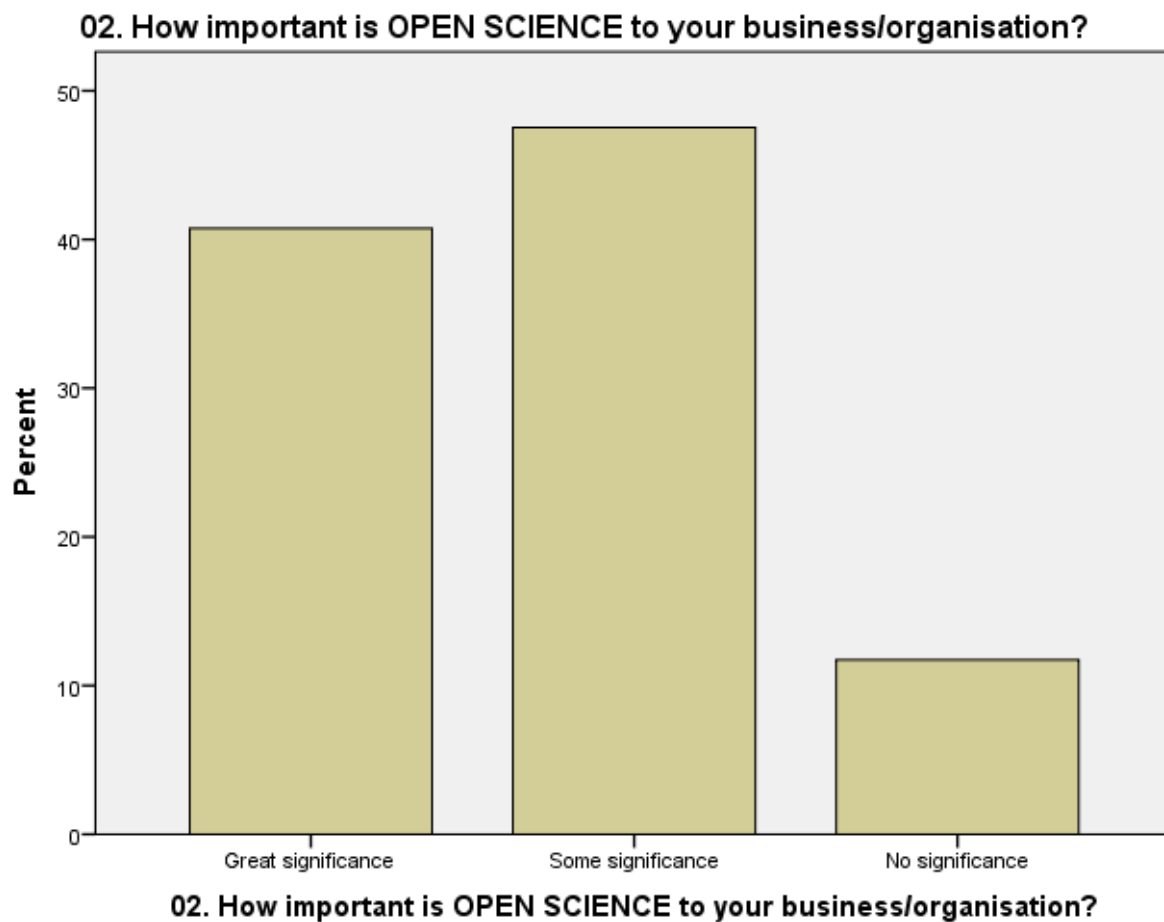
6 Appendix

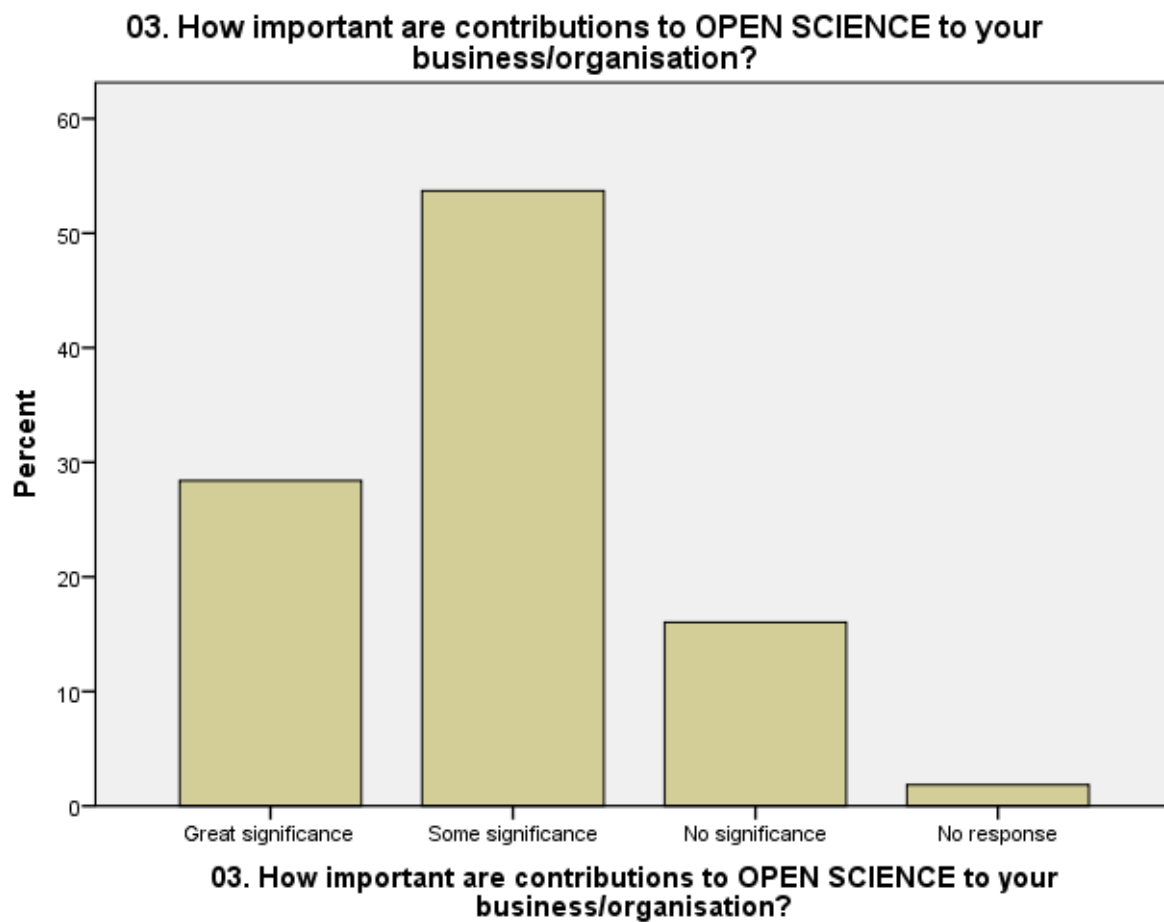
6.1 Abbreviations

AAT	Aeronautics & Air Transport
EU	European Union
WP	Work Package
SME	Small and Medium Enterprises
OEM	Original Equipment Manufacturer
ASD	AeroSpace and Defence Industries Association of Europe
IMG4	European Aviation Industry Network
FP6 / FP7	6 th /7 th Framework programme
OSCAR	Open ScienCe Aeronautic & Air Transport Research
CORDIS	Community Research and Development Information Service
ZAL	Hamburg's Center of Applied Aeronautical Research

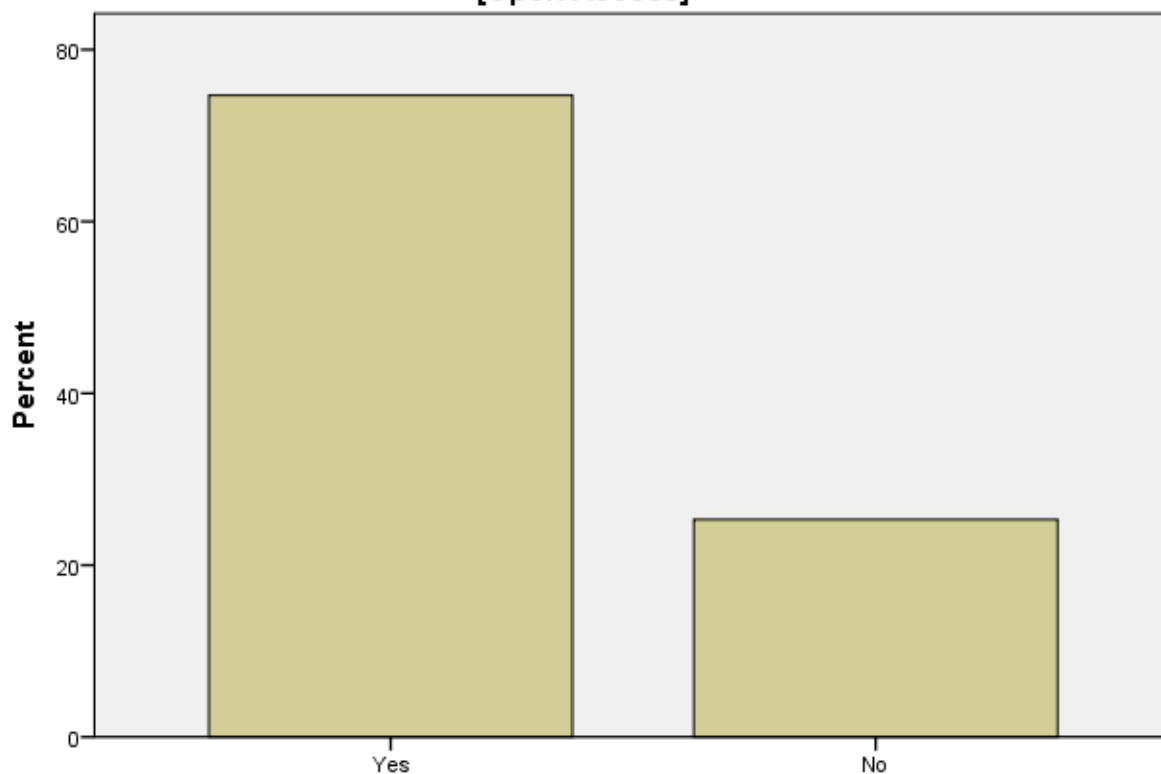
6.2 Analysis of the results of the Mini Survey





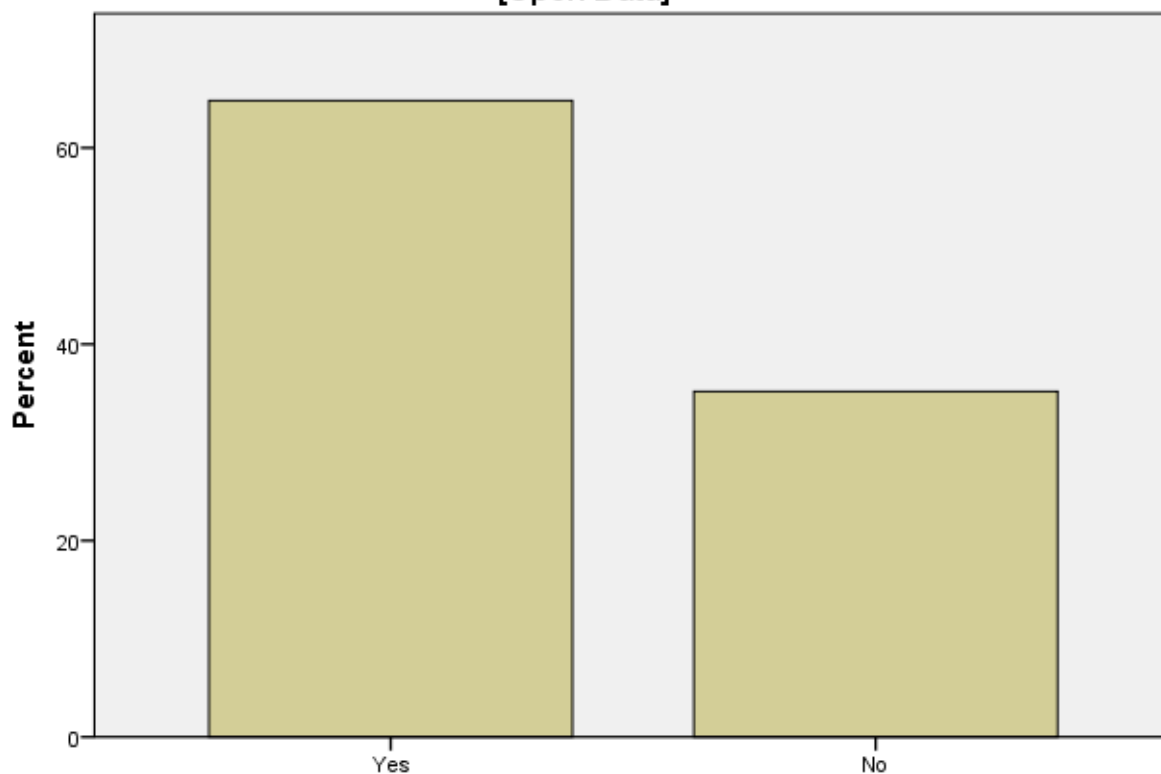


**04. Are you familiar with any of the following principles of OPEN SCIENCE?
[Open Access]**



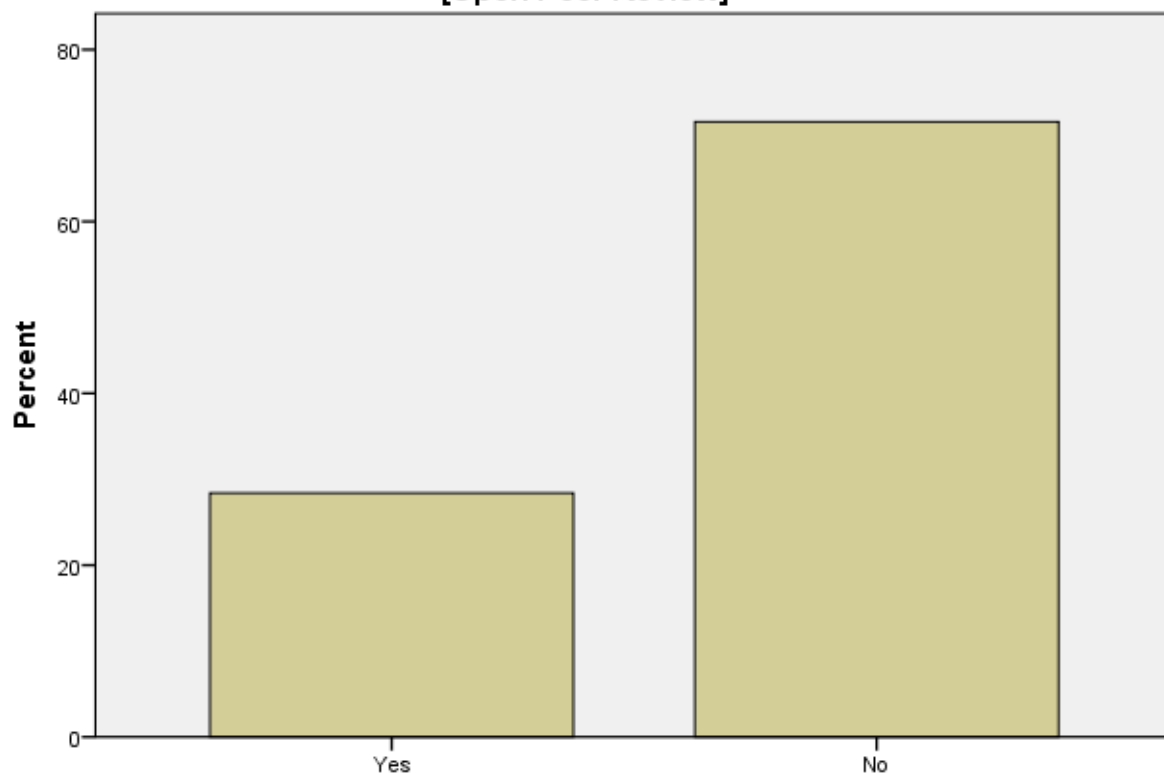
**04. Are you familiar with any of the following principles of OPEN SCIENCE?
[Open Access]**

**04. Are you familiar with any of the following principles of OPEN SCIENCE?
[Open Data]**



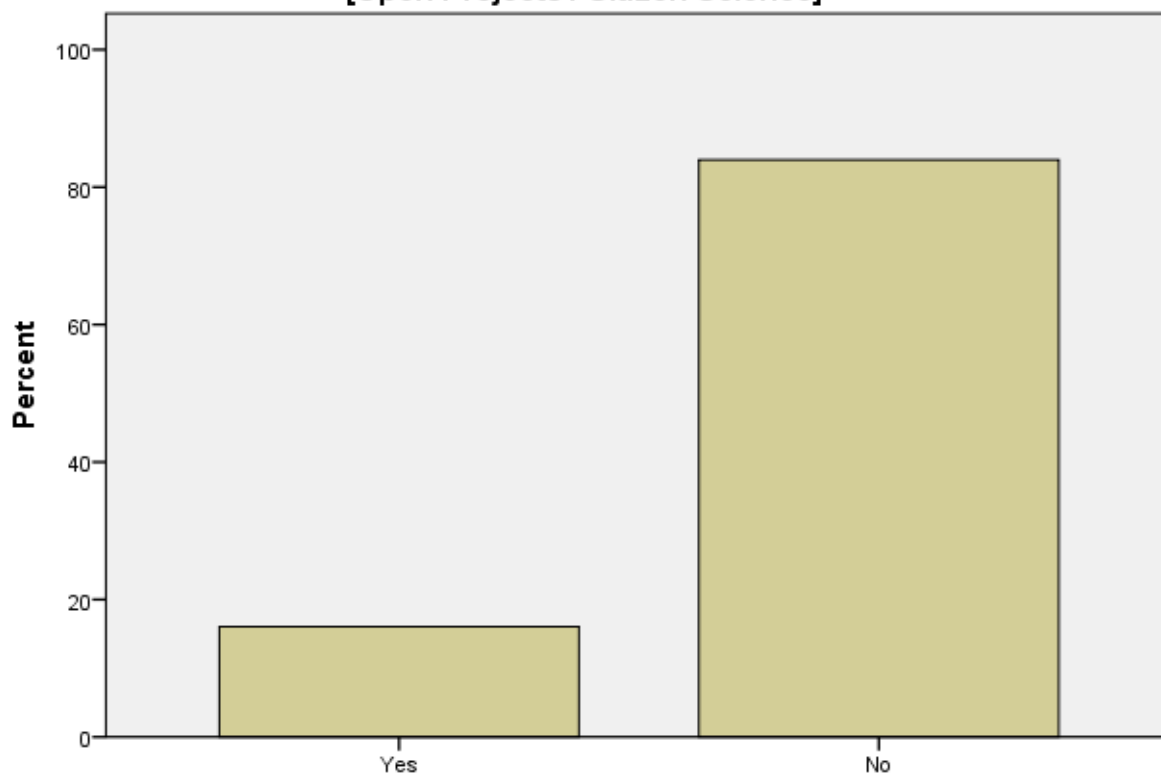
**04. Are you familiar with any of the following principles of OPEN SCIENCE?
[Open Data]**

**04. Are you familiar with any of the following principles of OPEN SCIENCE?
[Open Peer Review]**



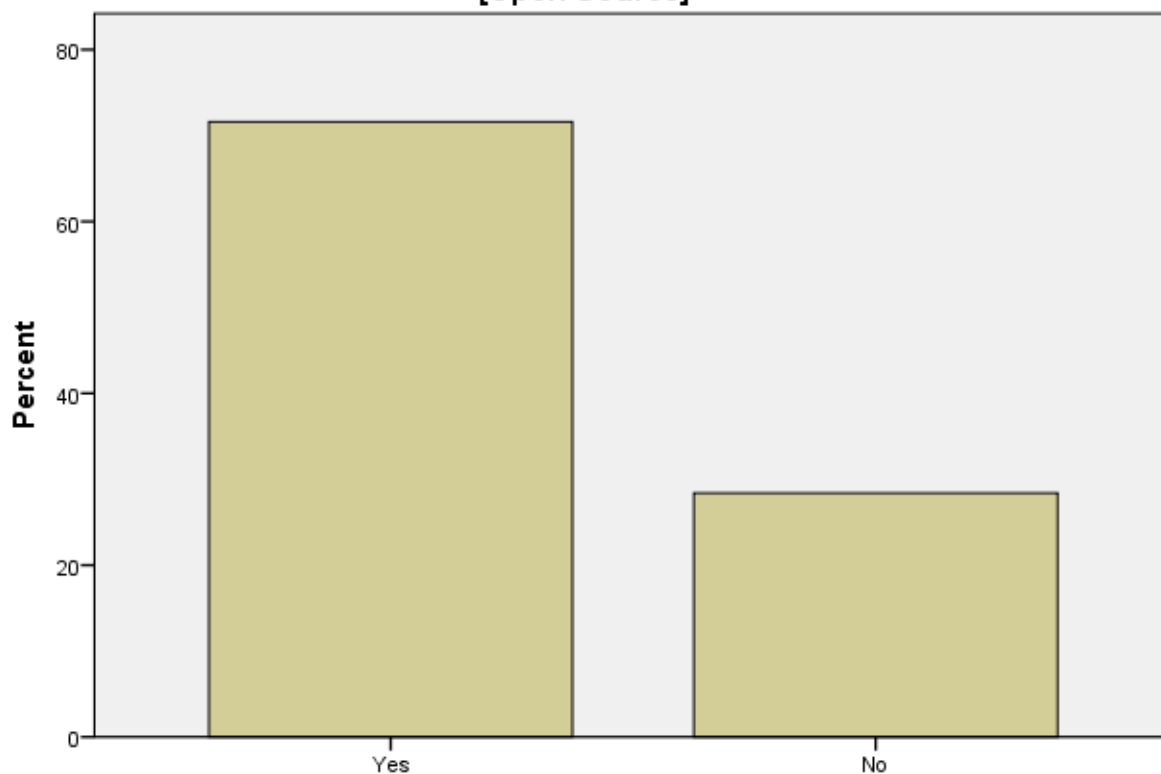
**04. Are you familiar with any of the following principles of OPEN SCIENCE?
[Open Peer Review]**

**04. Are you familiar with any of the following principles of OPEN SCIENCE?
[Open Projects / Citizen Science]**



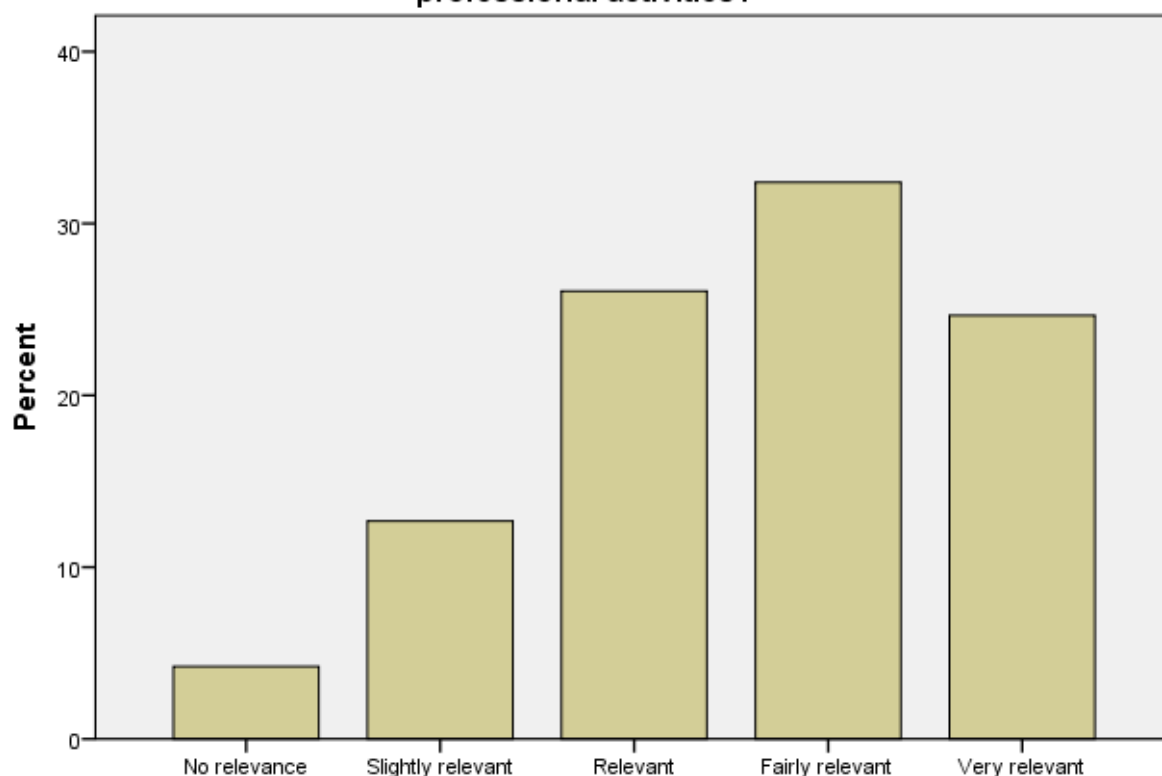
**04. Are you familiar with any of the following principles of OPEN SCIENCE?
[Open Projects / Citizen Science]**

**04. Are you familiar with any of the following principles of OPEN SCIENCE?
[Open Source]**



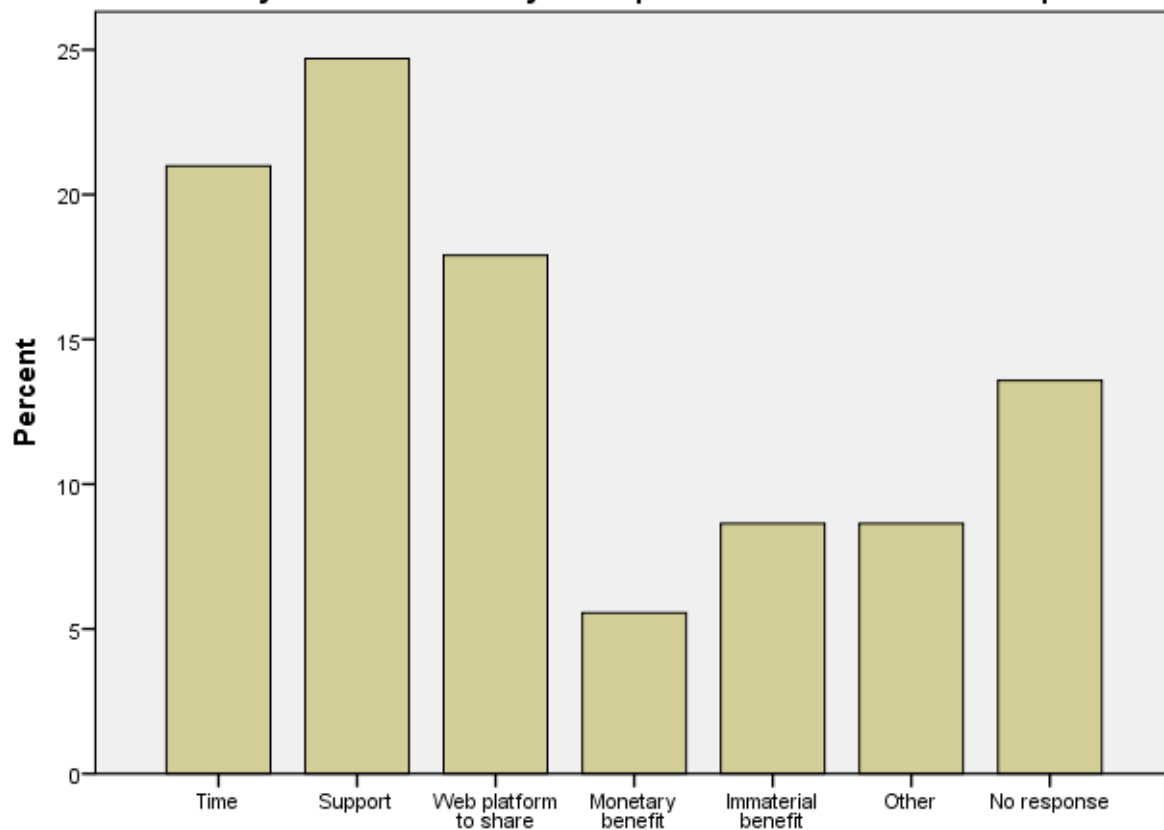
**04. Are you familiar with any of the following principles of OPEN SCIENCE?
[Open Source]**

05. What relevance has Open Access to scientific research related to your professional activities?

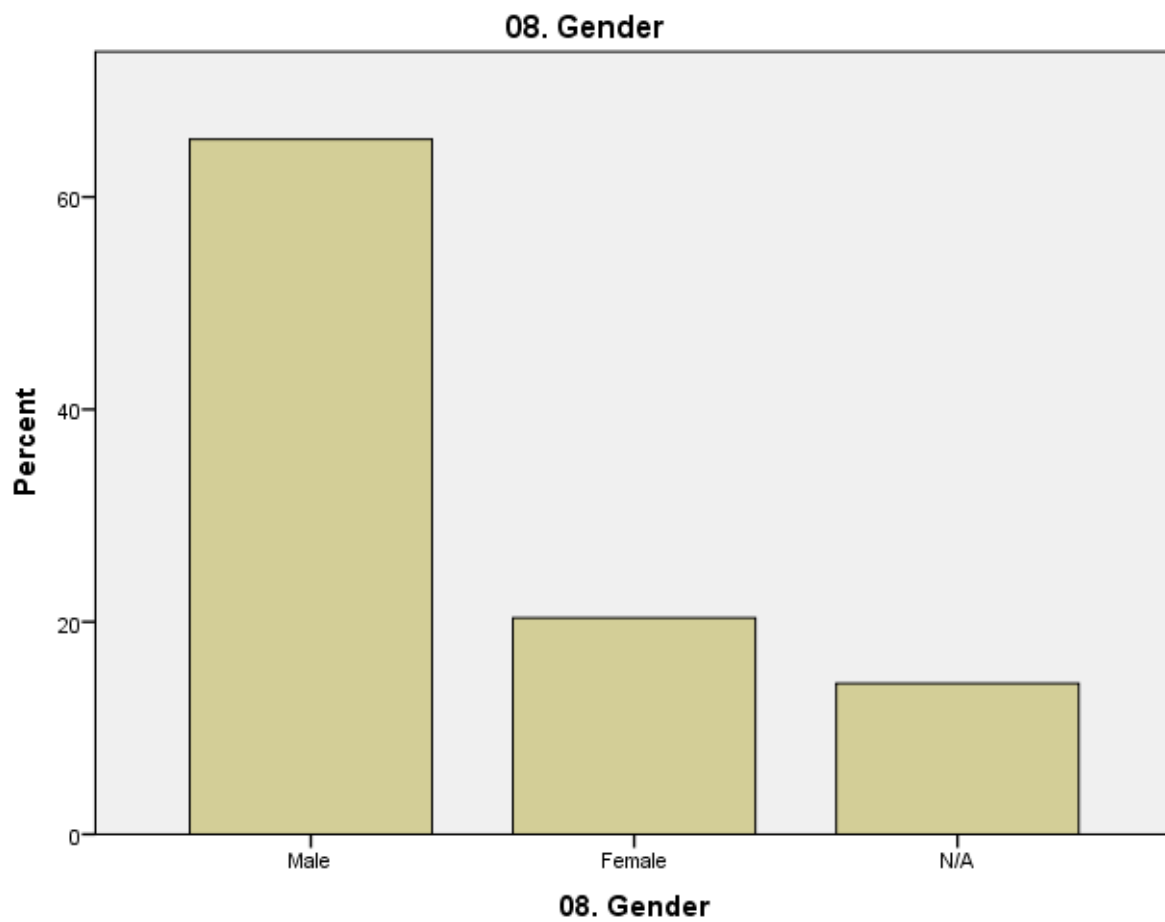


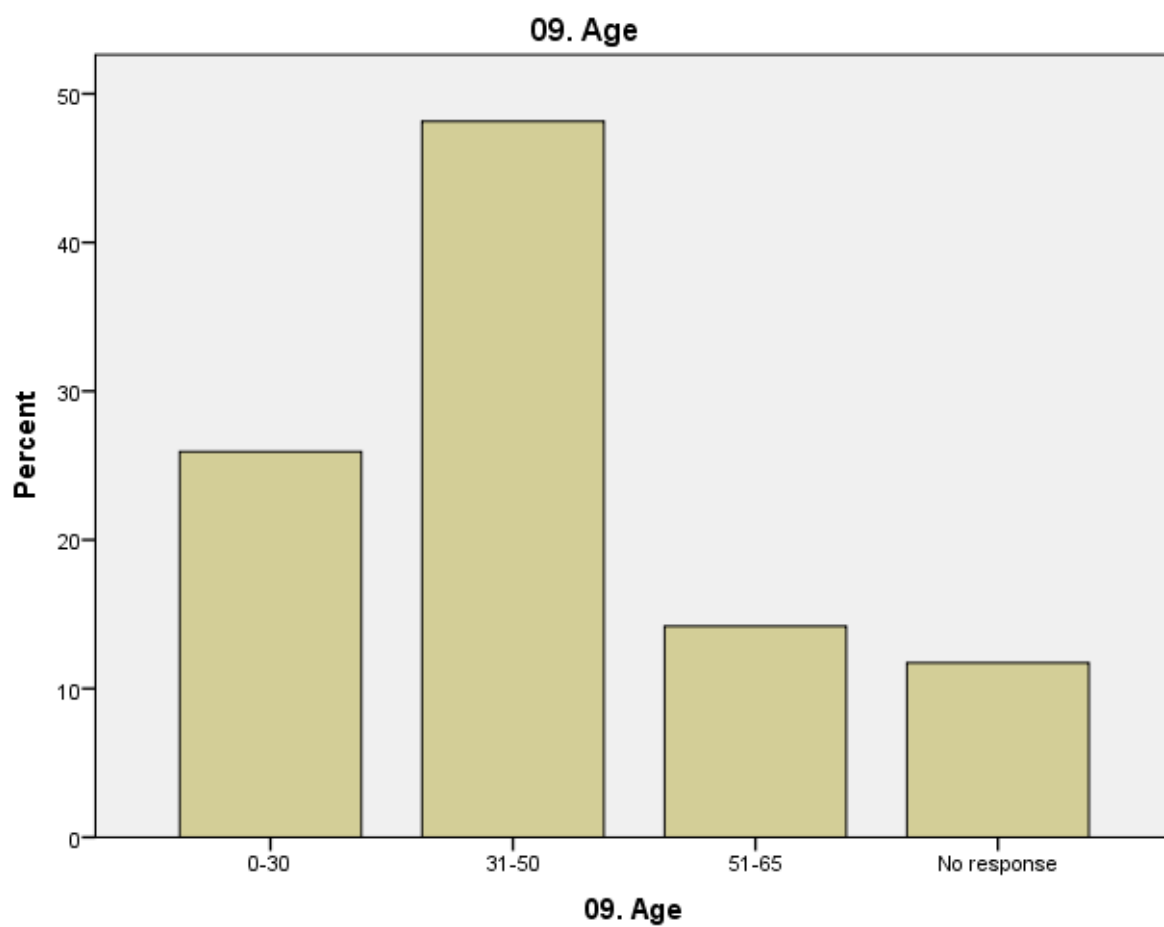
05. What relevance has Open Access to scientific research related to your professional activities?

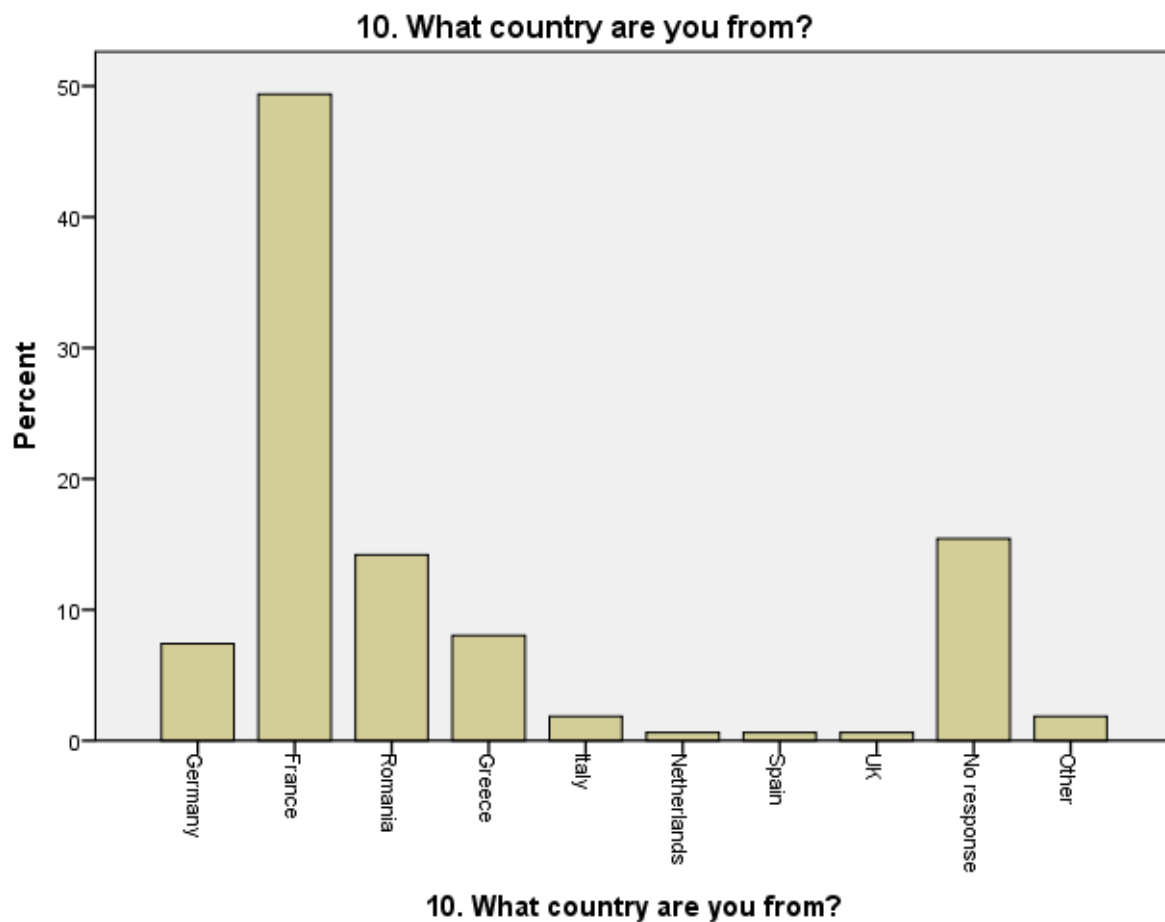
06. What would you need to make your experiences accessible to the public:

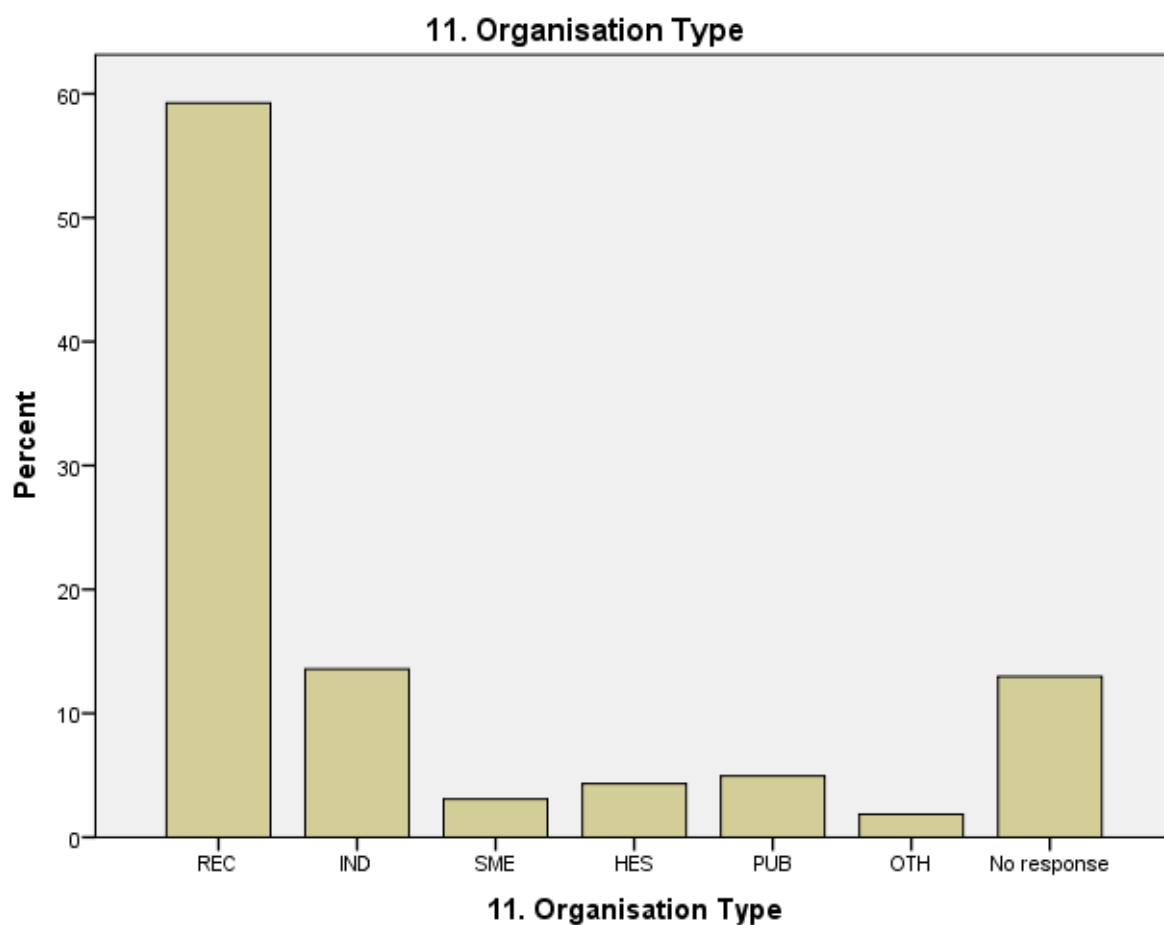


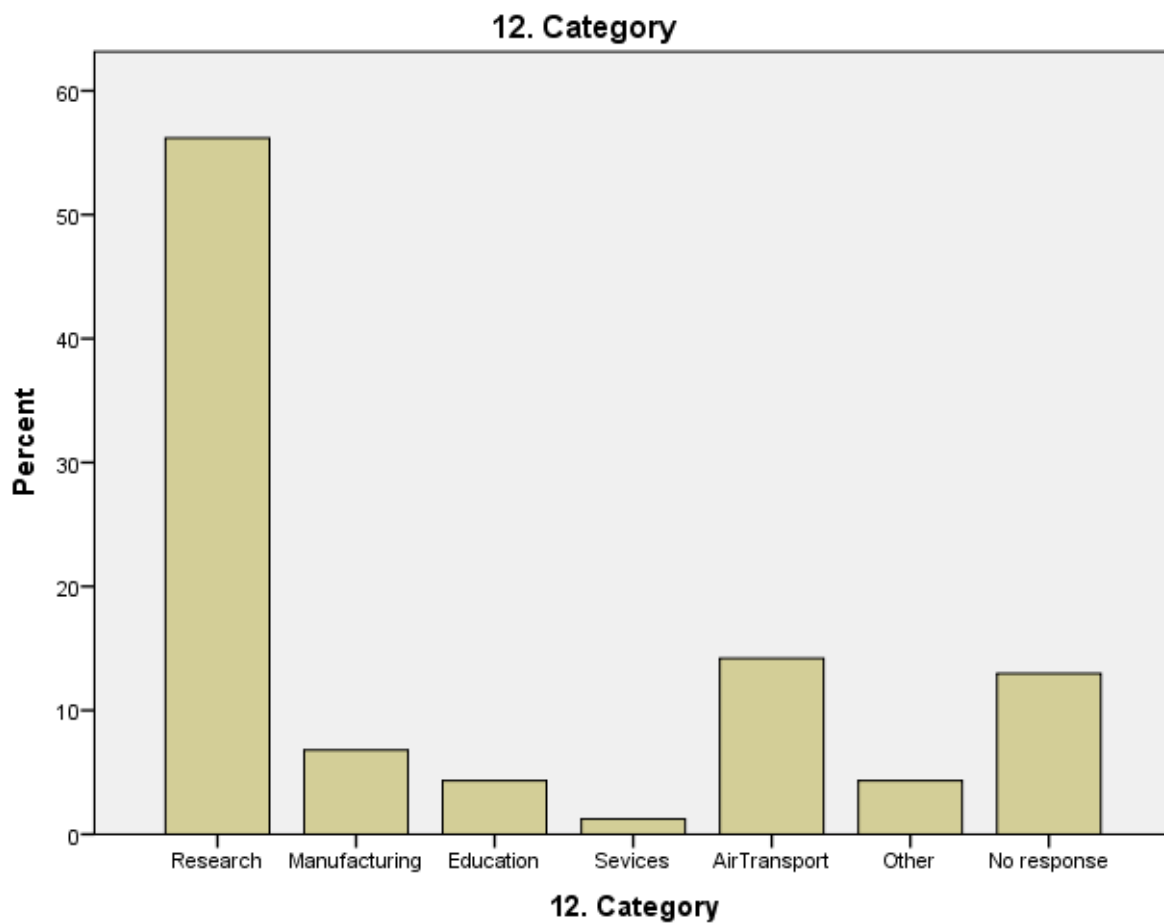
06. What would you need to make your experiences accessible to the public:

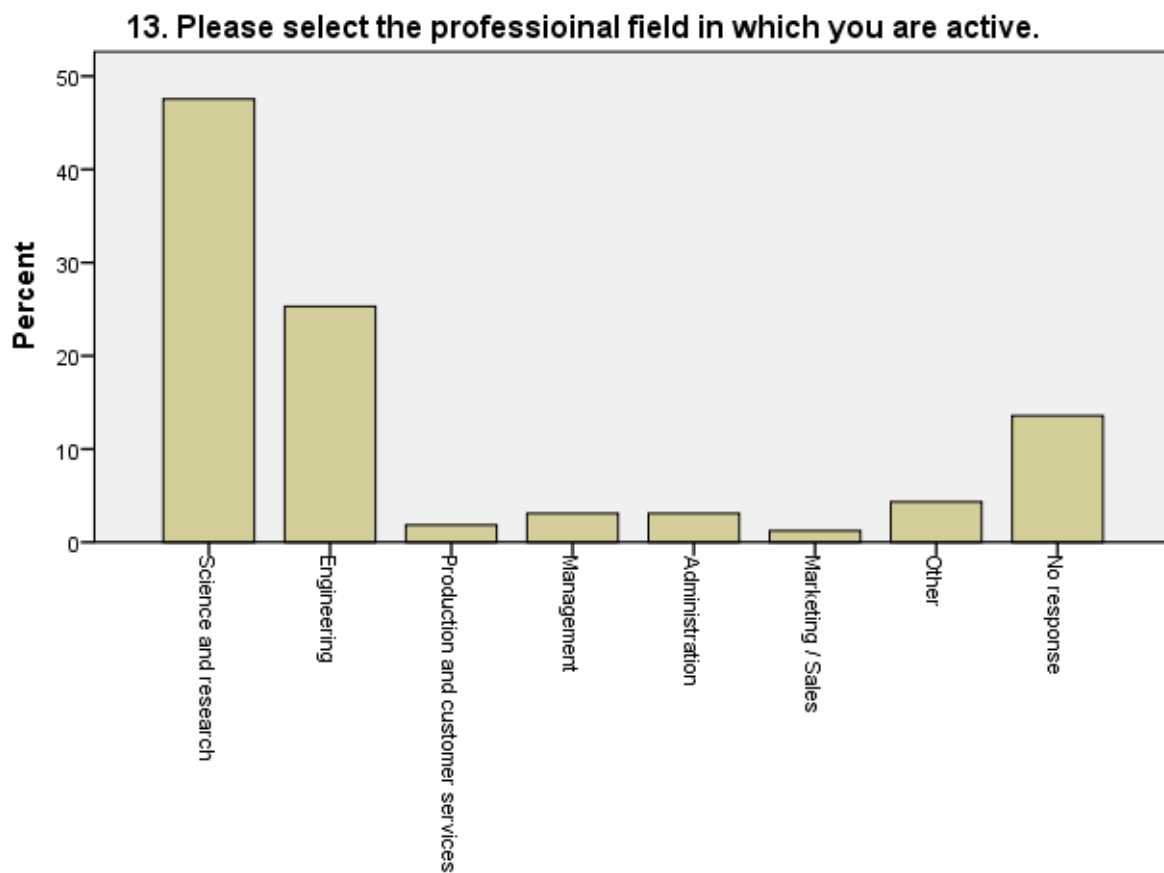






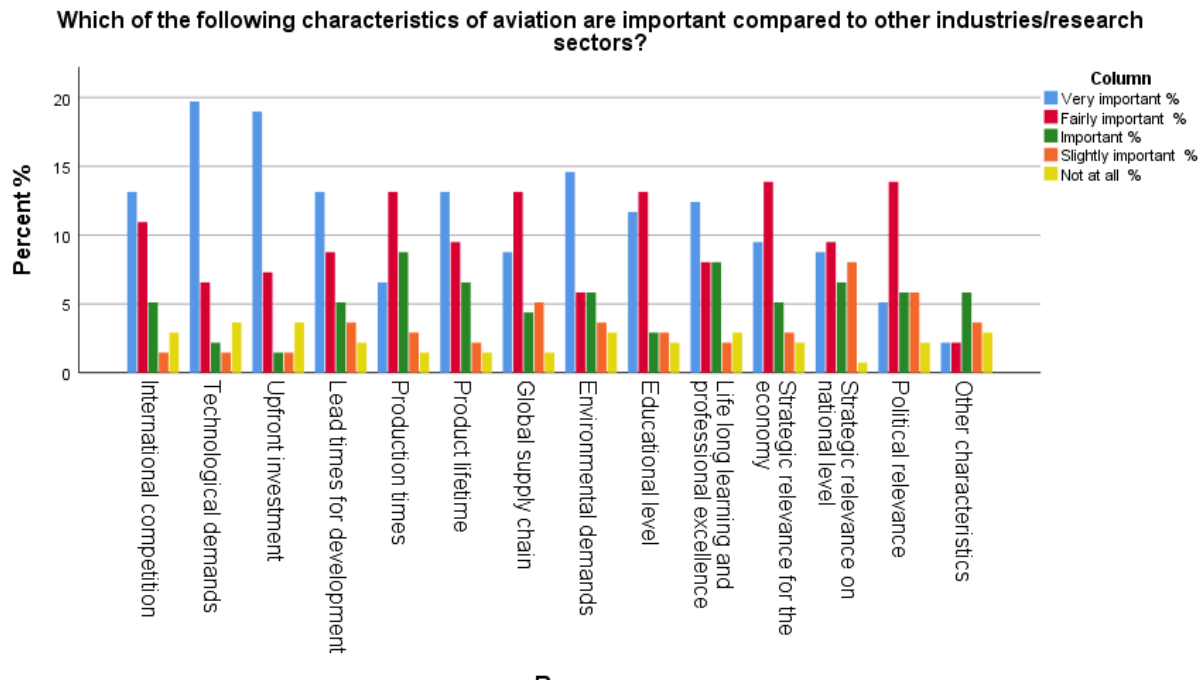
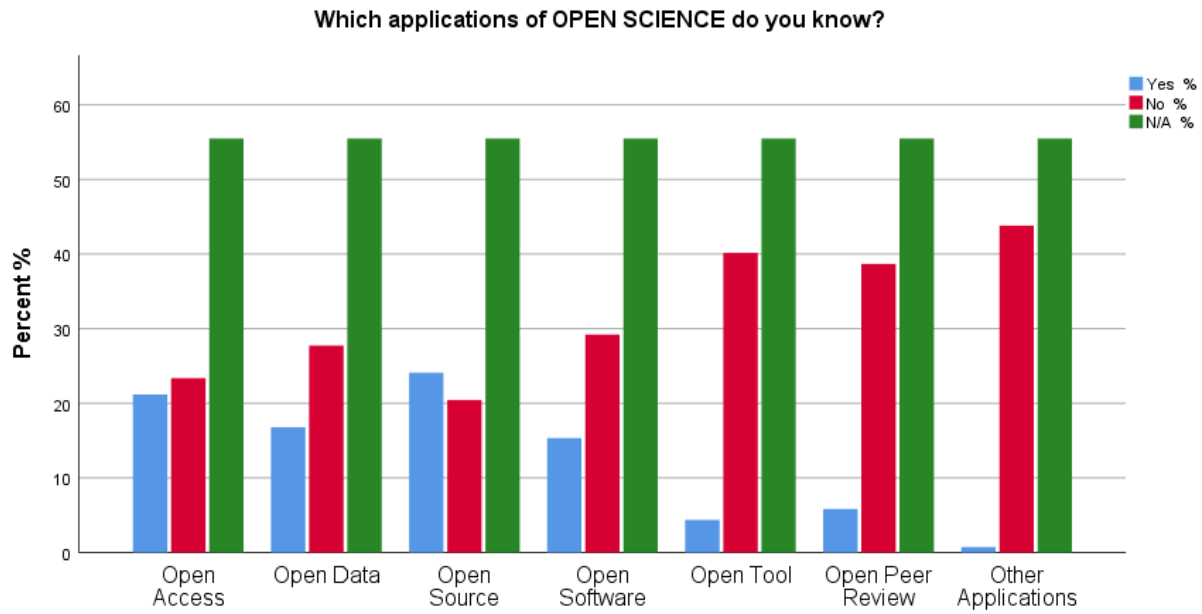




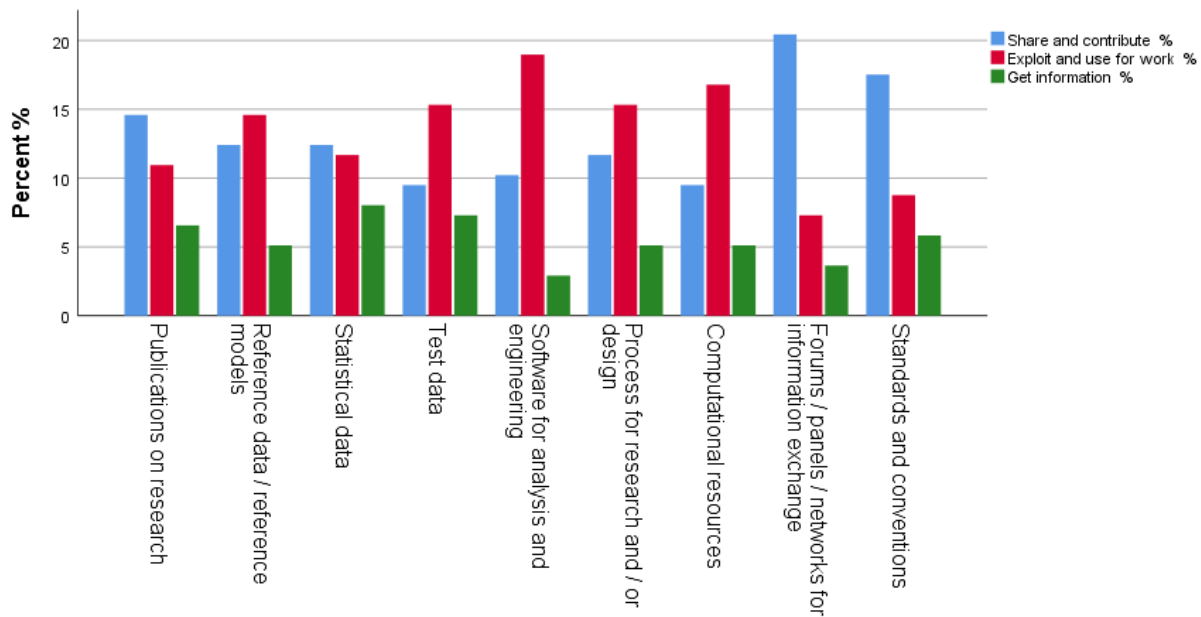


13. Please select the professional field in which you are active.

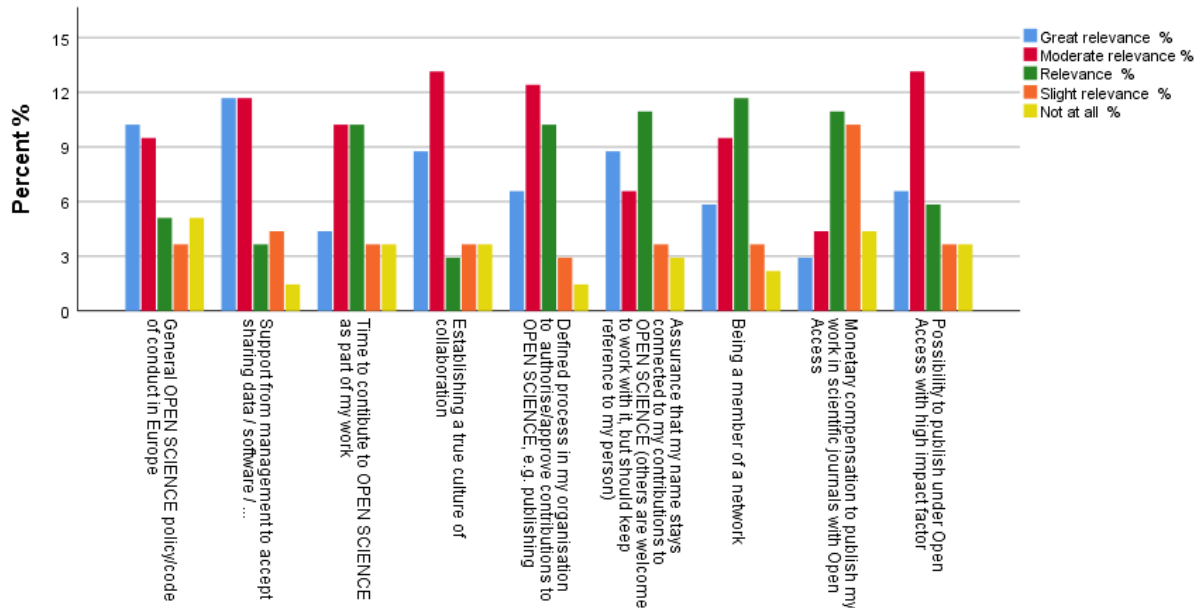
6.3 Analysis of the results of the Big Survey



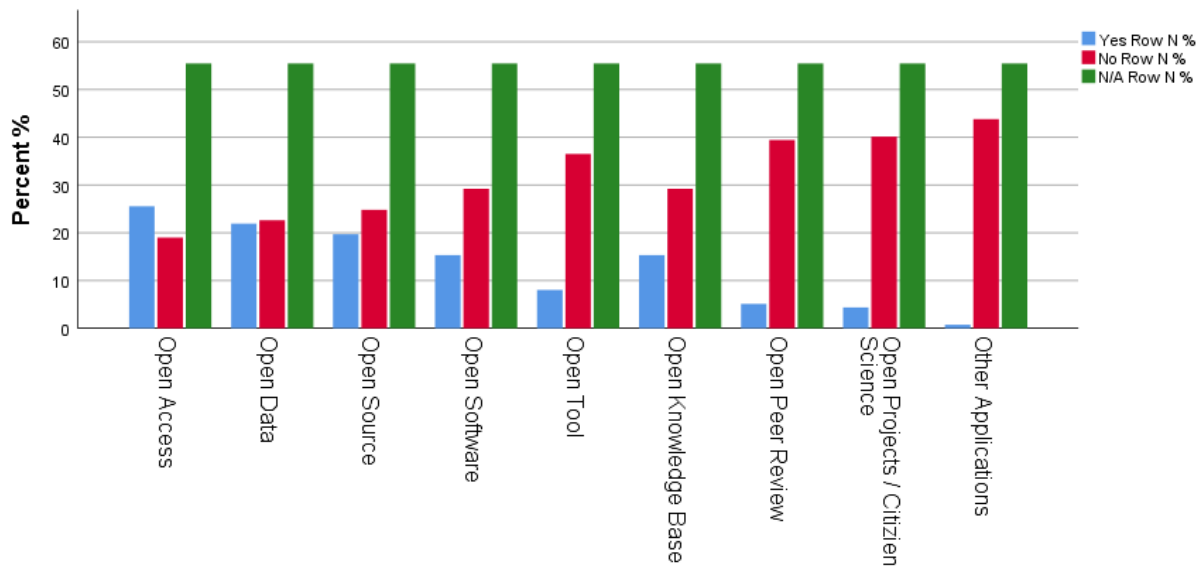
What applications are particularly helpful and/or shall be strengthened for aviation research?



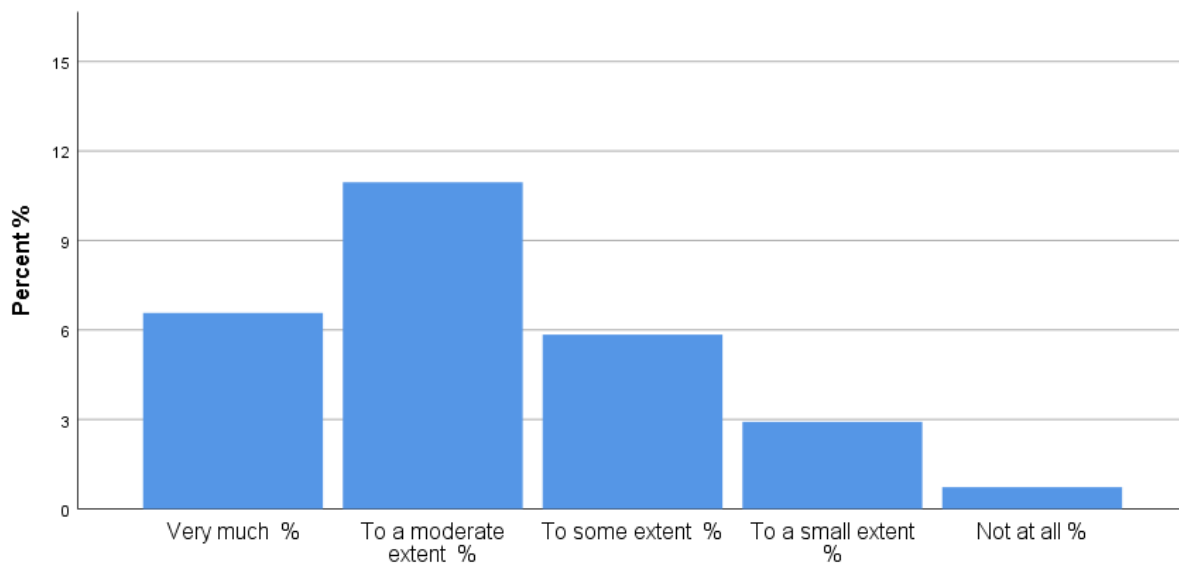
The following points were mentioned as being of important for the further progress of OPEN SCIENCE in aviation. What is your opinion?



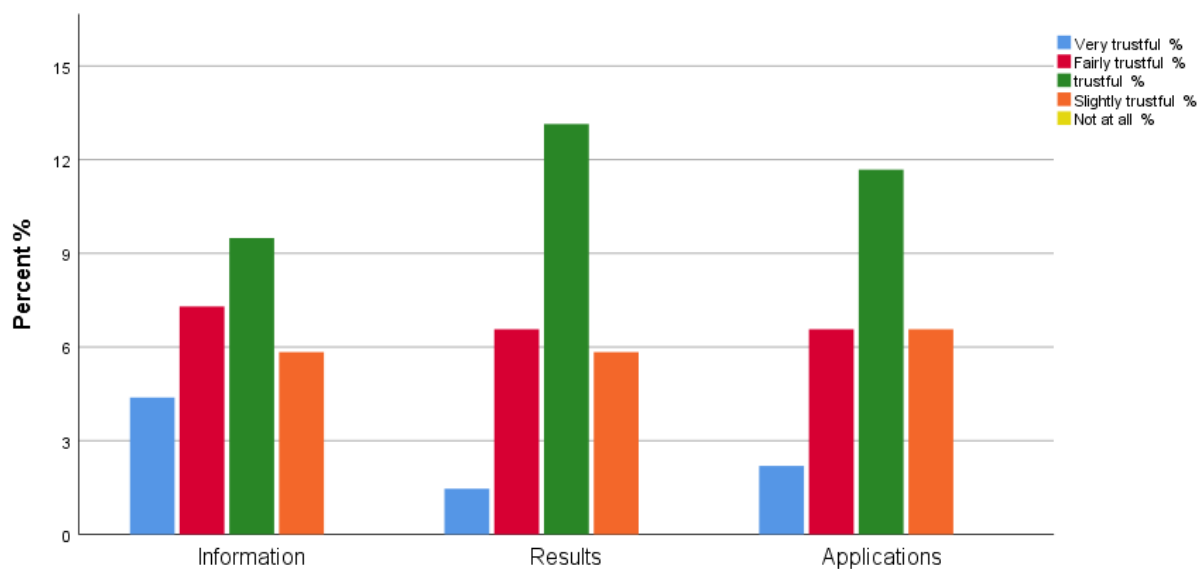
Which principles of OPEN SCIENCE are relevant for your work?



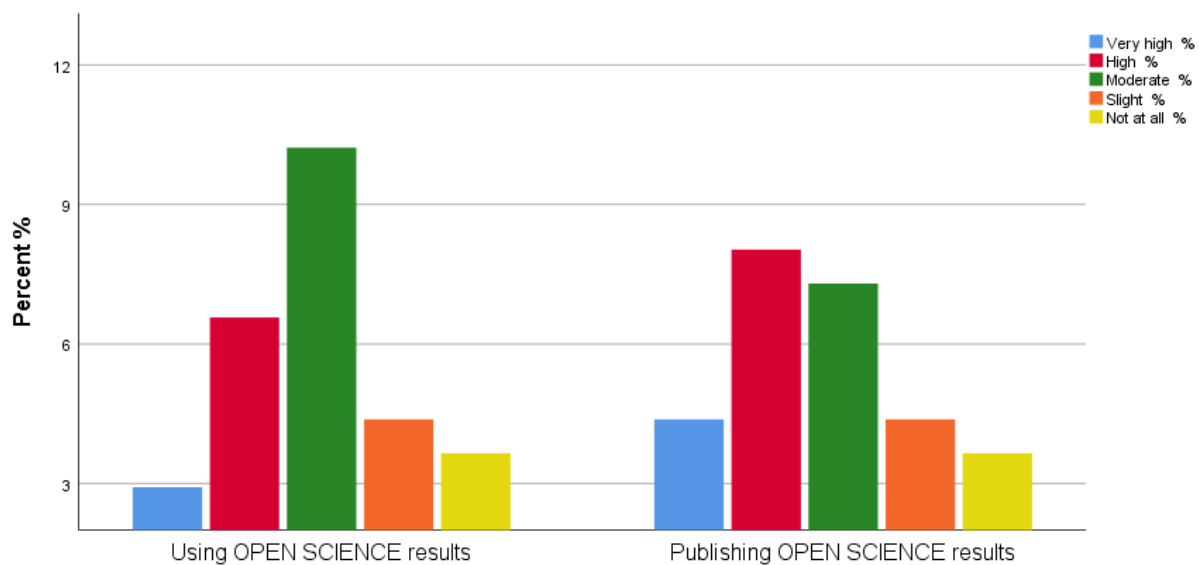
How interested are you in getting information or other content from OPEN SCIENCE?



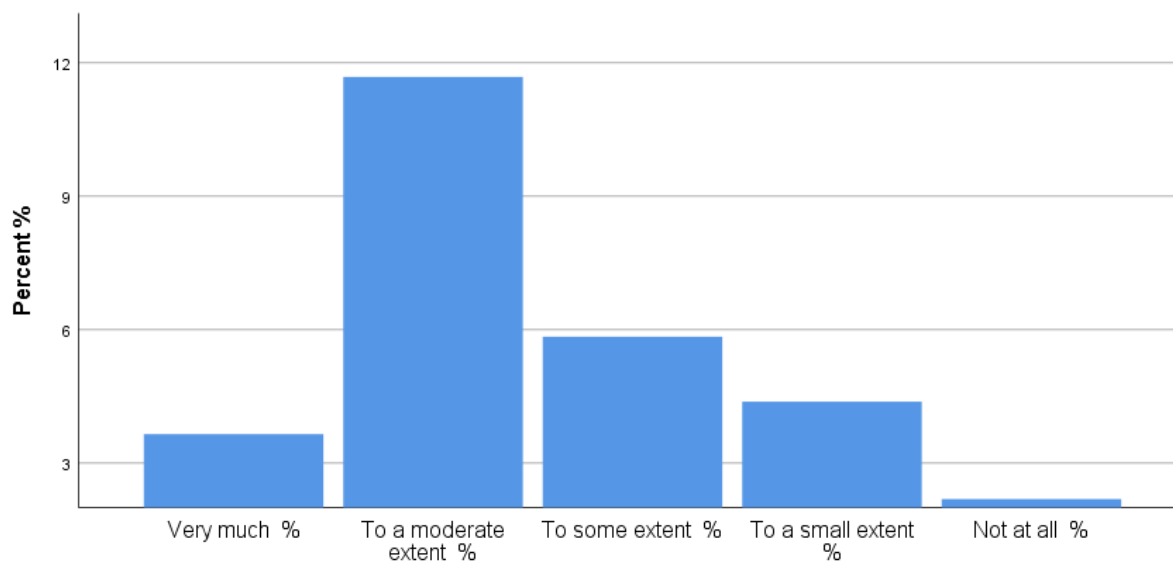
To what extent is it possible today to trust the following content of OPEN SCIENCE?



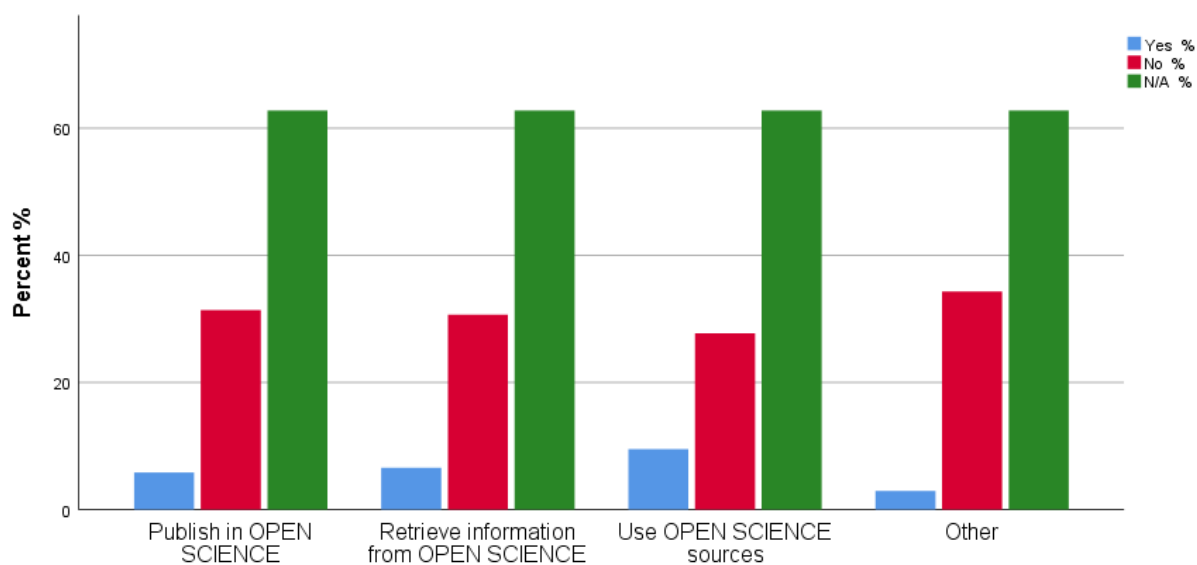
Do you see any problems, ...



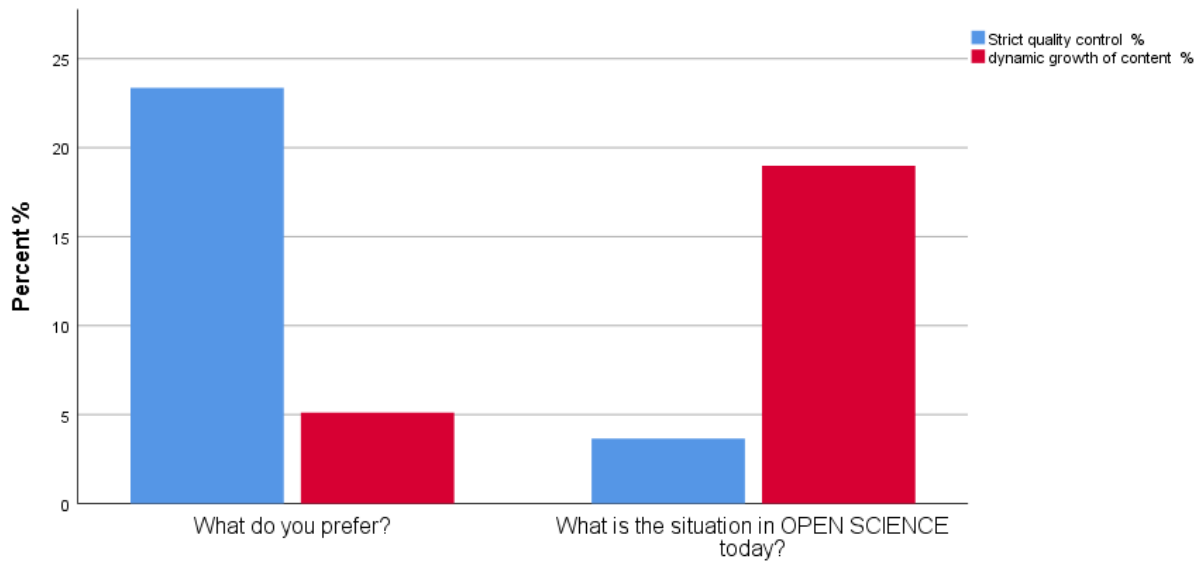
Do you expect to profit from a wider use of OPEN SCIENCE?



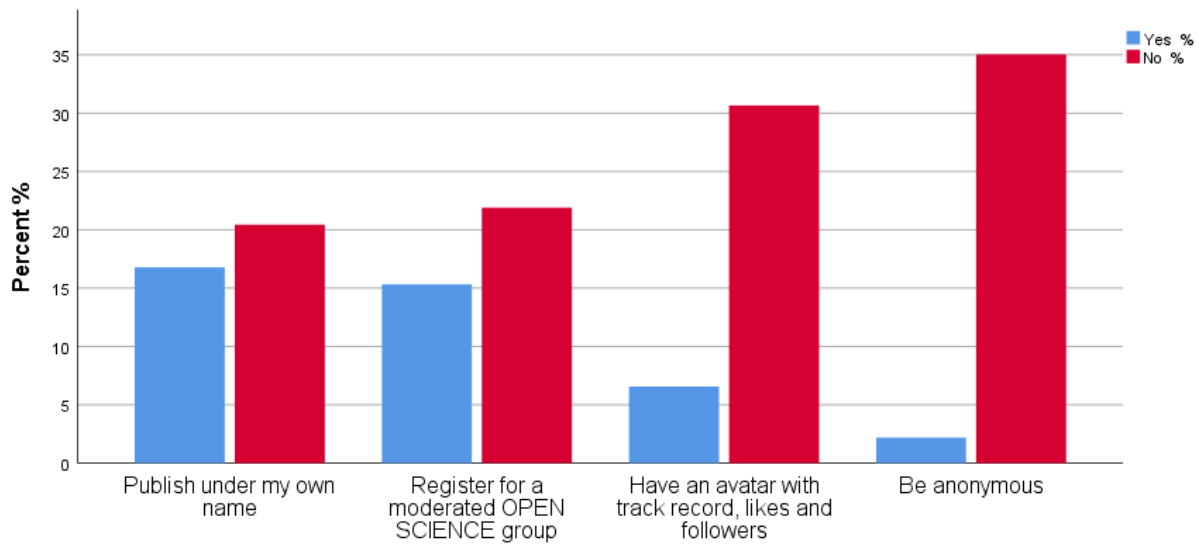
How do you use OPEN SCIENCE today?



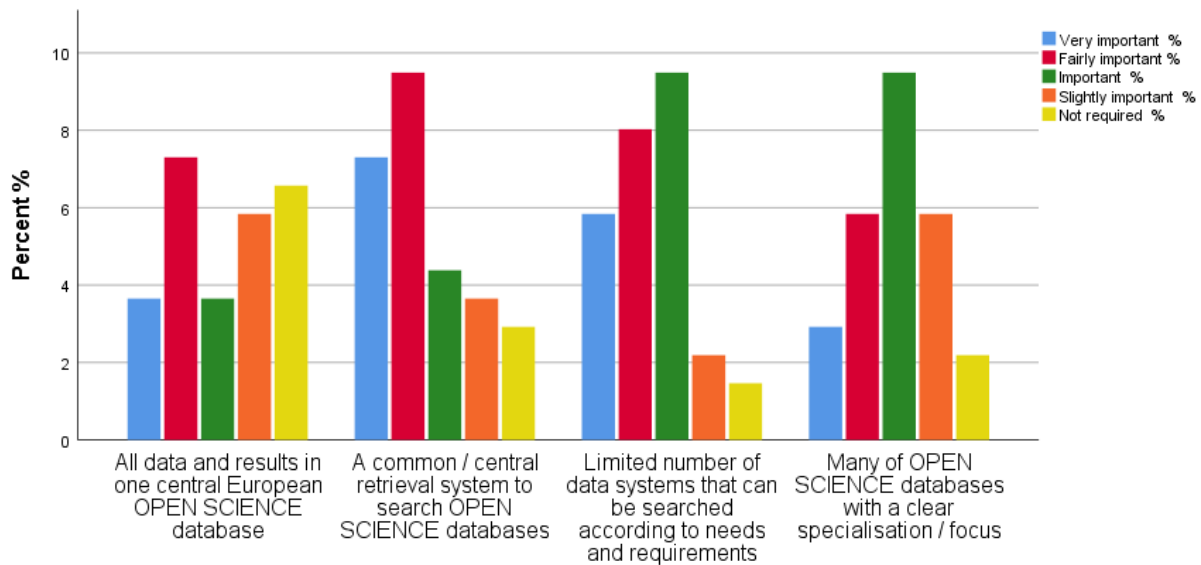
The more controlling of OPEN SCIENCE on quality, the less content will be available. What is more important for you?



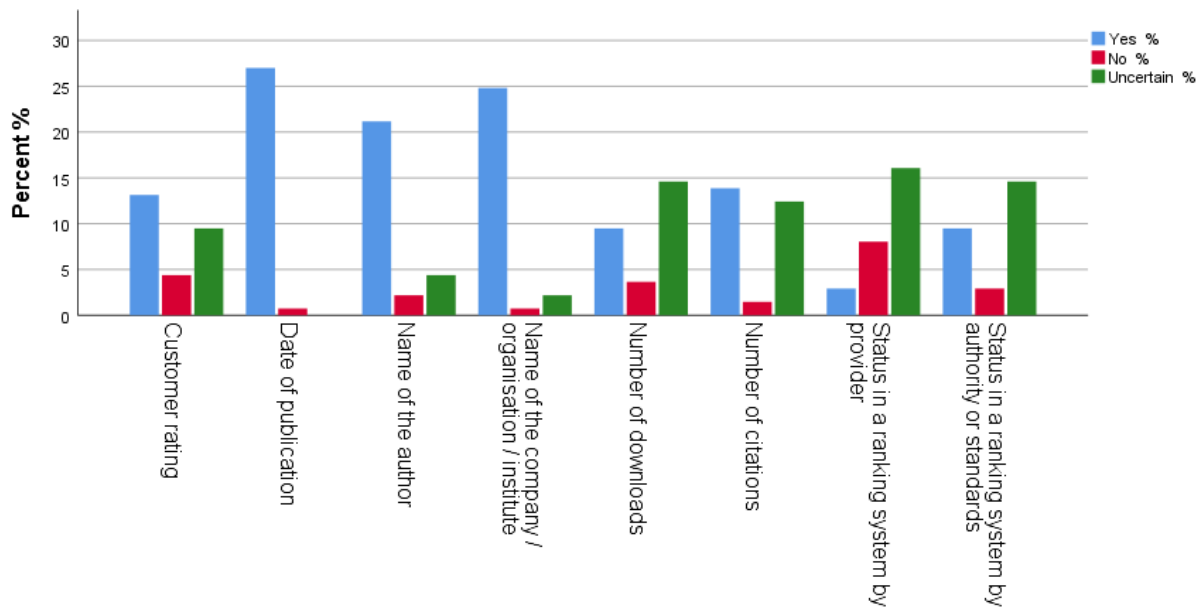
What level of anonymity would you prefer in order to contribute to OPEN SCIENCE? I would like to be able to:



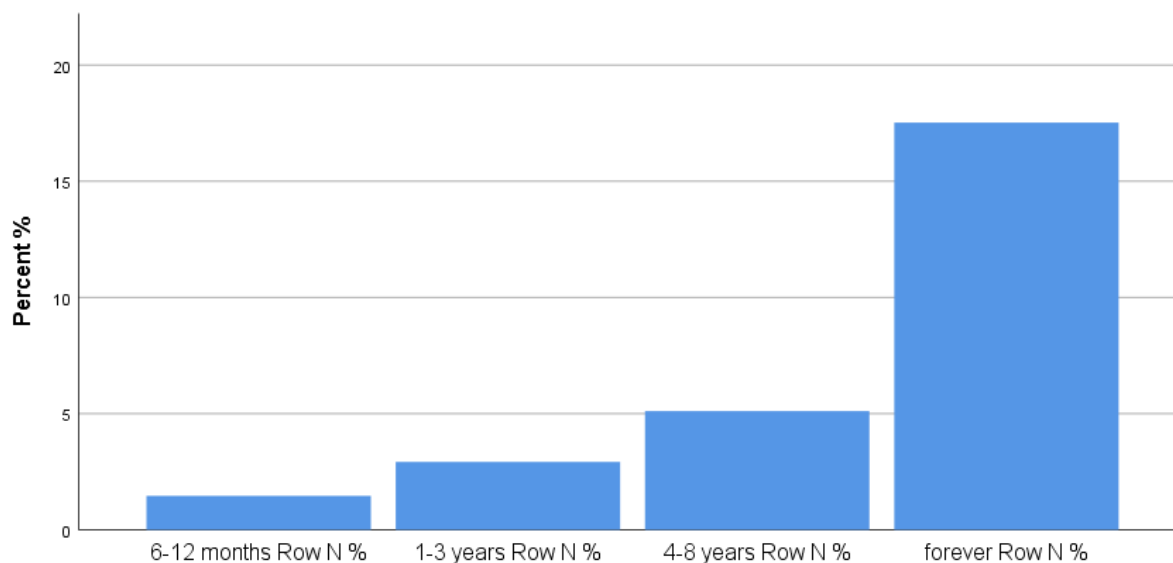
Retrieval. What kind of system do you prefer?



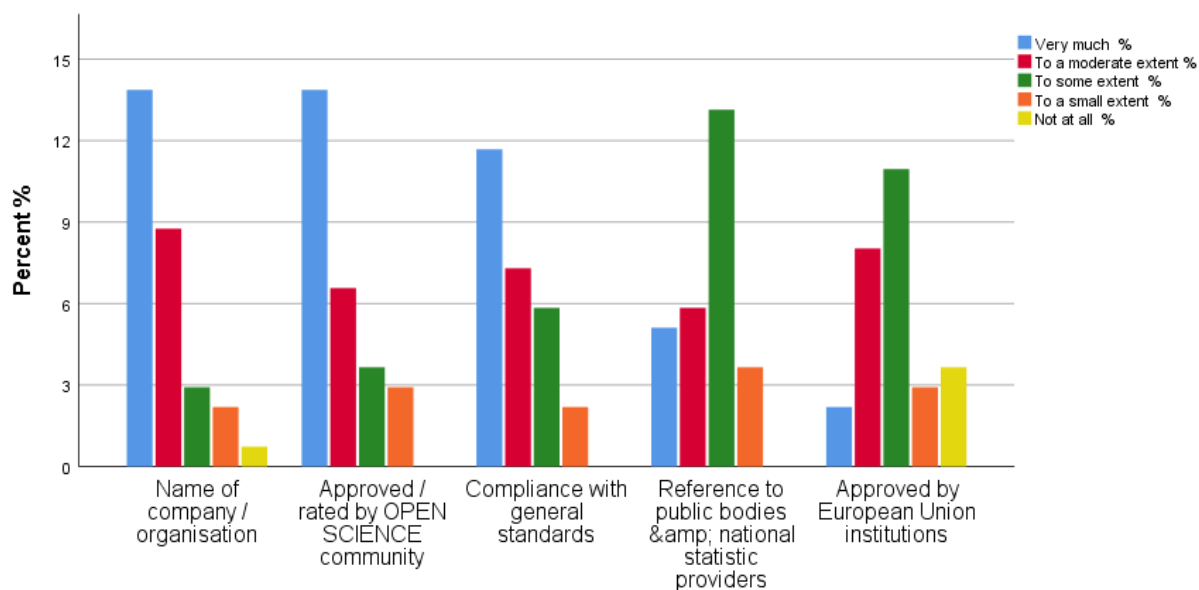
What additional data on OPEN SCIENCE contributions (e.g. publications, test data, procedures) should be made TRACEABLE?



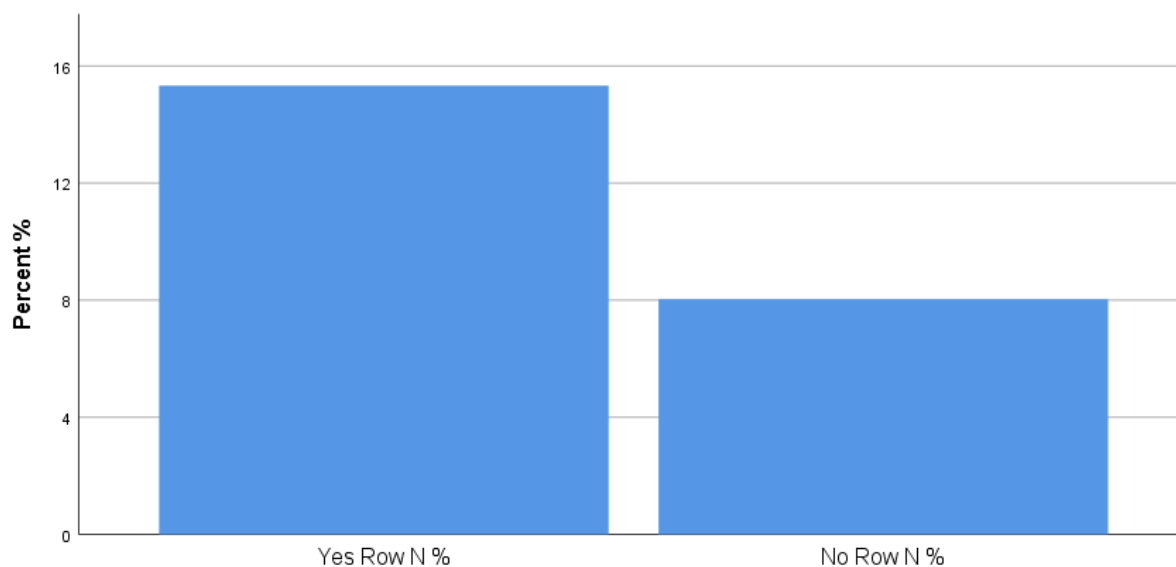
How long should information stay available?



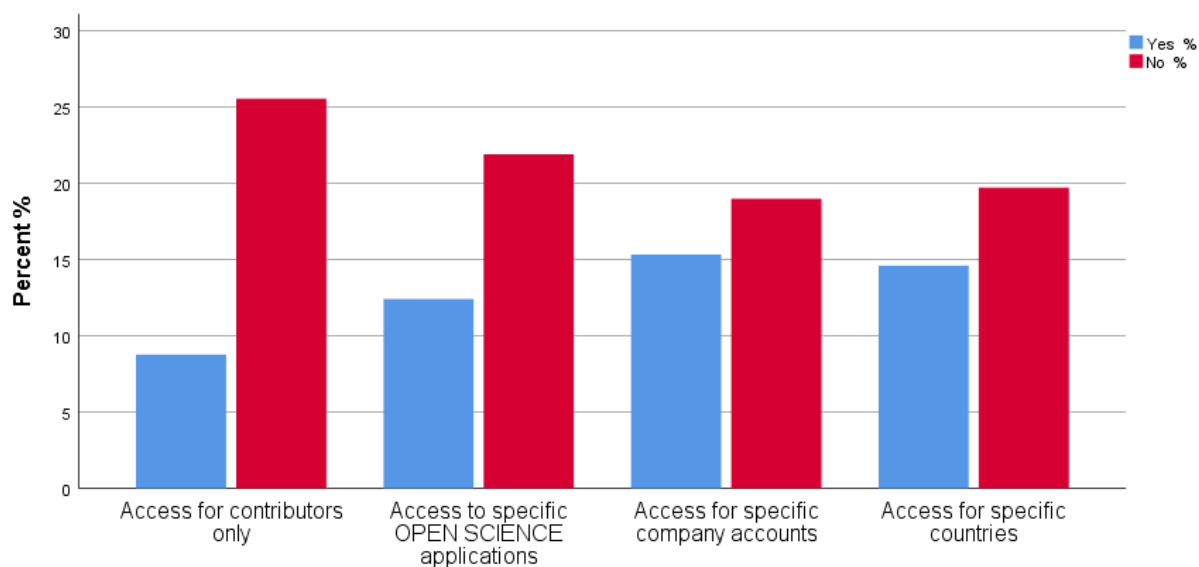
What kind of proof for OPEN SCIENCE documents would be important for you?



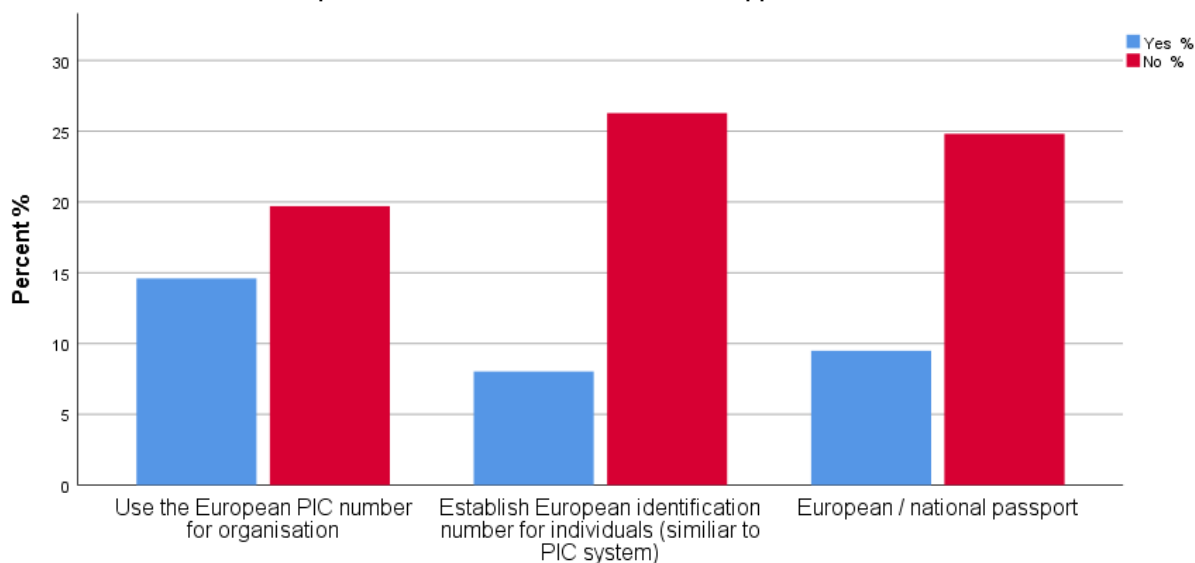
Is there a need for access regulations to OPEN SCIENCE?



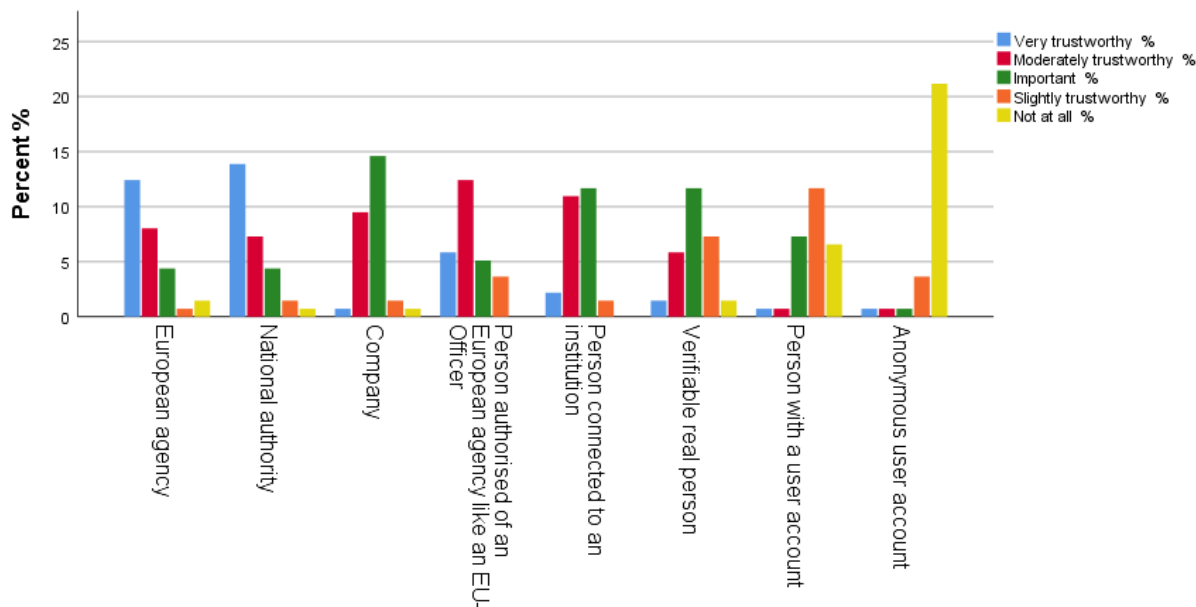
If there is a need for access regulations to OPEN SCIENCE than: How can access regulations to sources look like?



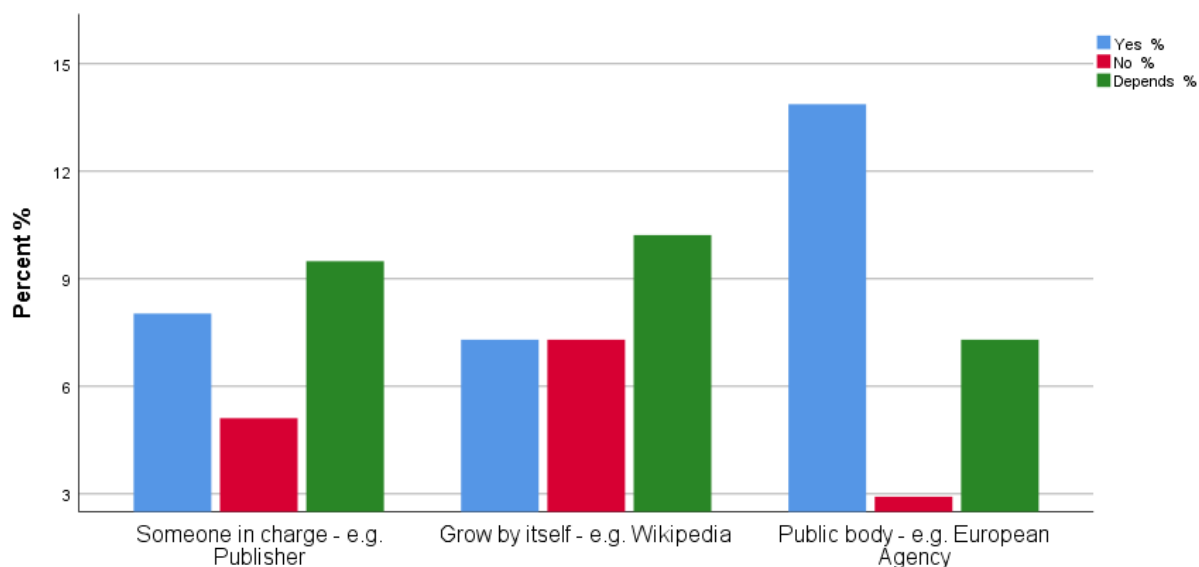
If there is a need for access regulations to OPEN SCIENCE, then...: Is there a special way to get permission to access OPEN SCIENCE applications?



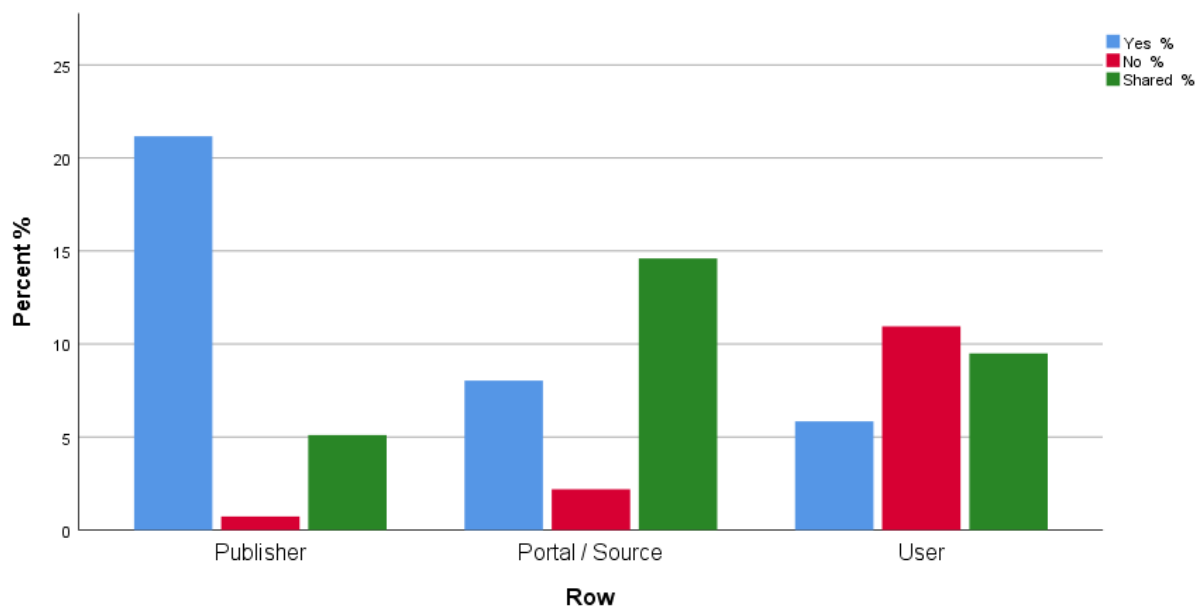
How trustworthy do you consider information in OPEN SCIENCE when it is published by...?



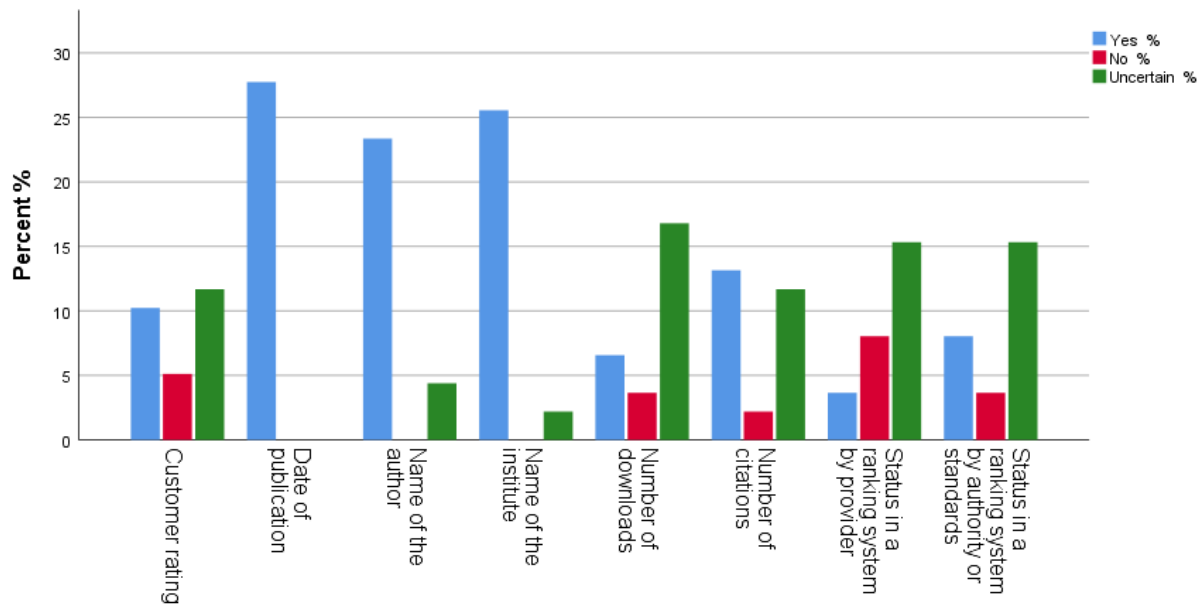
Is the documentation of OPEN SCIENCE applications to be lead by... ?



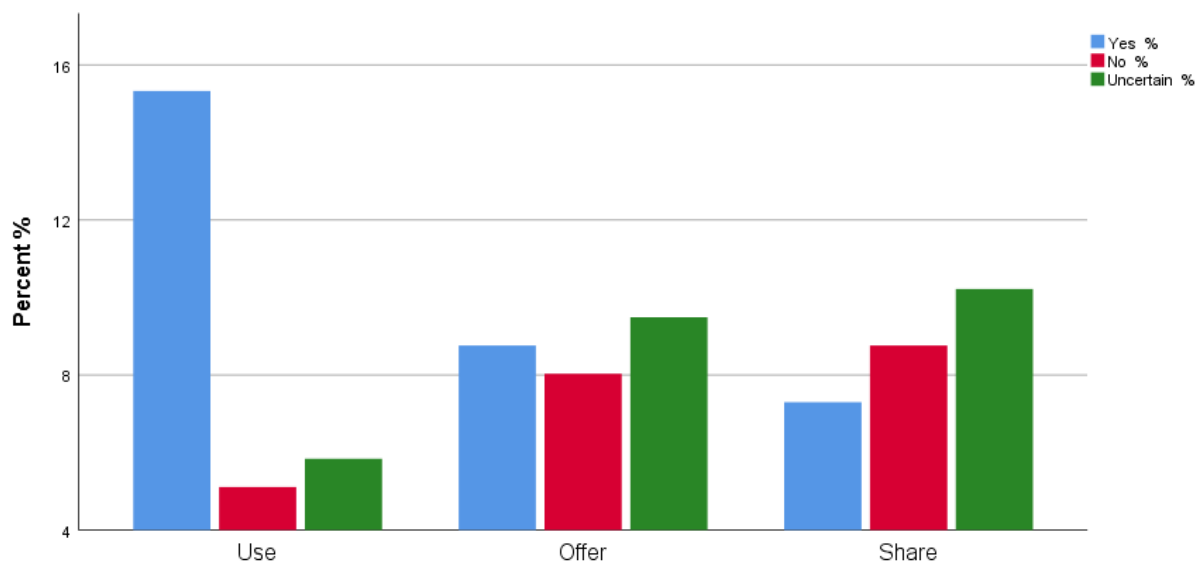
Responsibility for quality of published data is an issue of ...



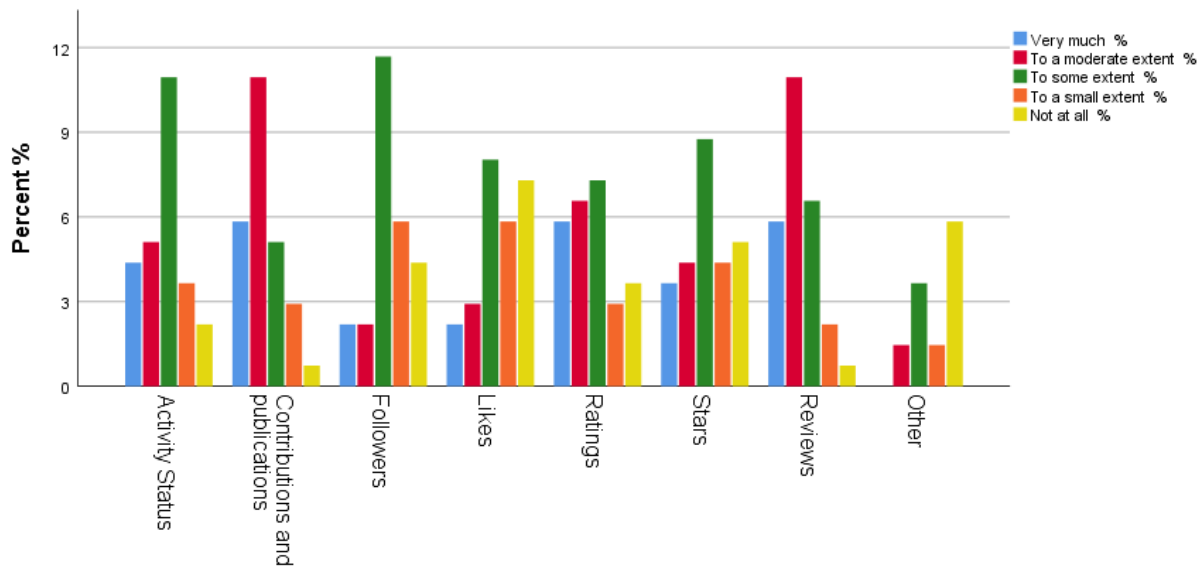
What additional data on OPEN SCIENCE contribution (e.g. publications, test data, procedures) should be PUBLISHED?



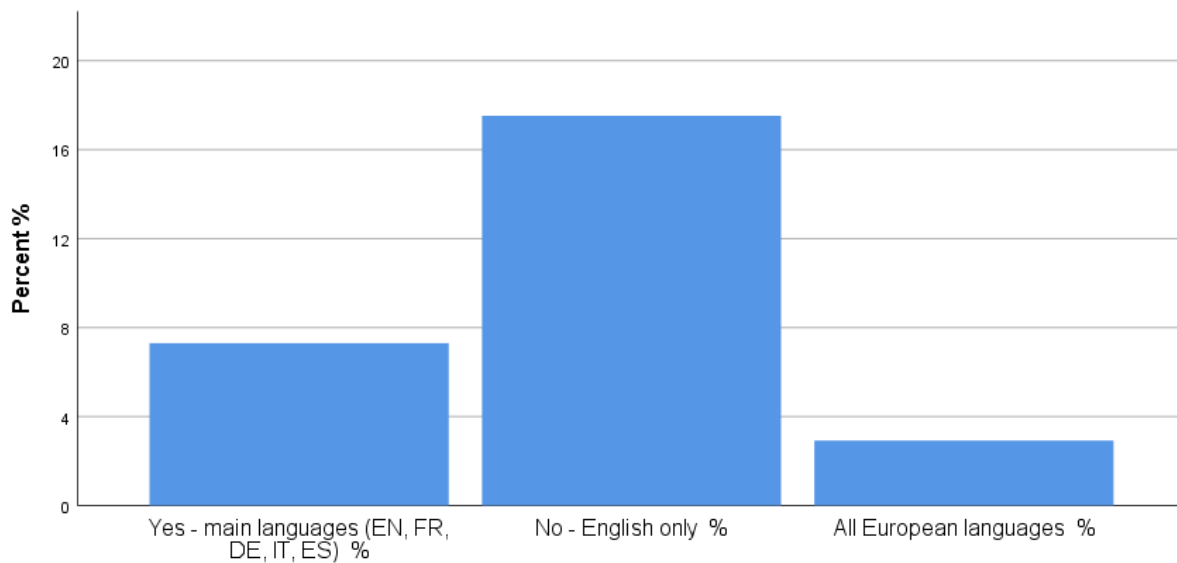
Is it currently possible for you to ... OPEN SCIENCE applications?



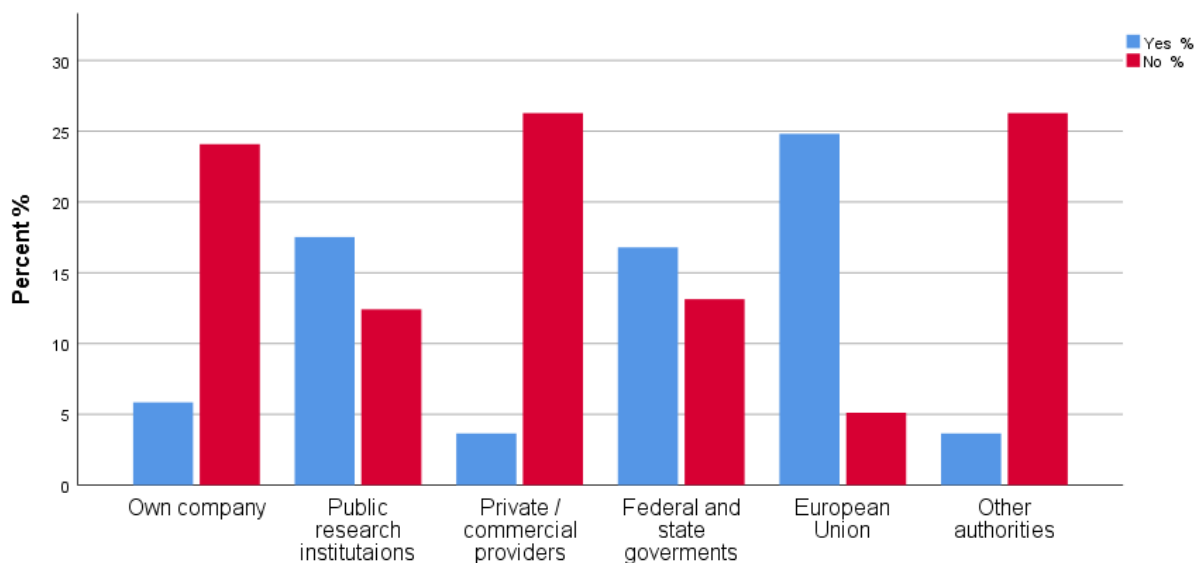
Can scores such as ... support quality and behaviour in OPEN SCIENCE portals?



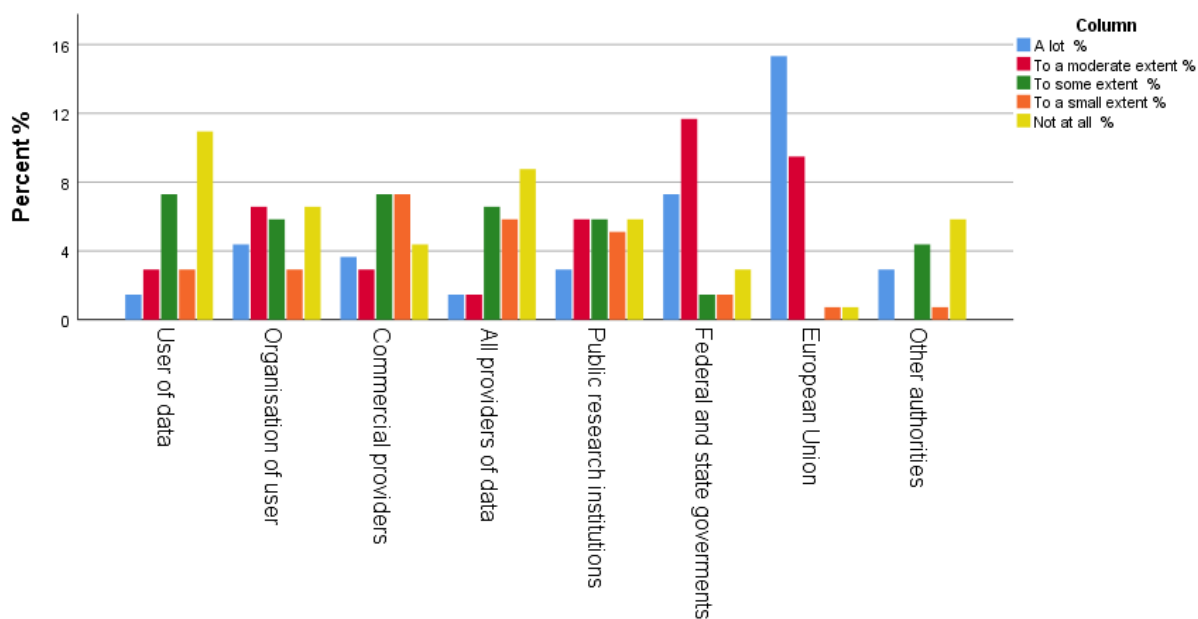
Should OPEN SCIENCE be available in other languages than English?



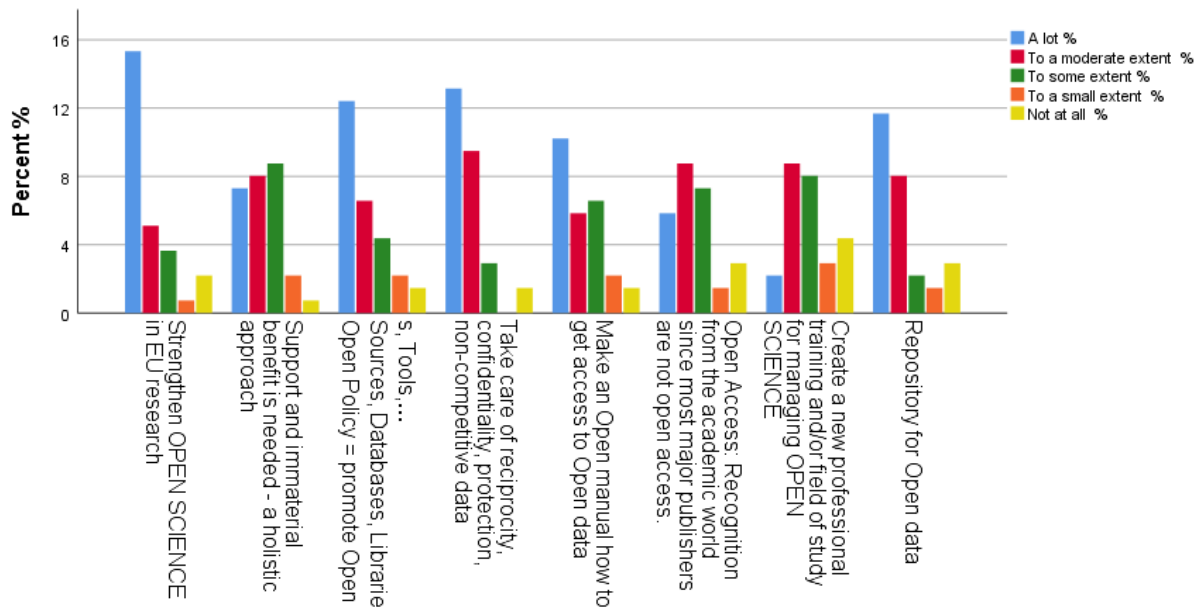
Which organisations should provide capacity and space for digital content?



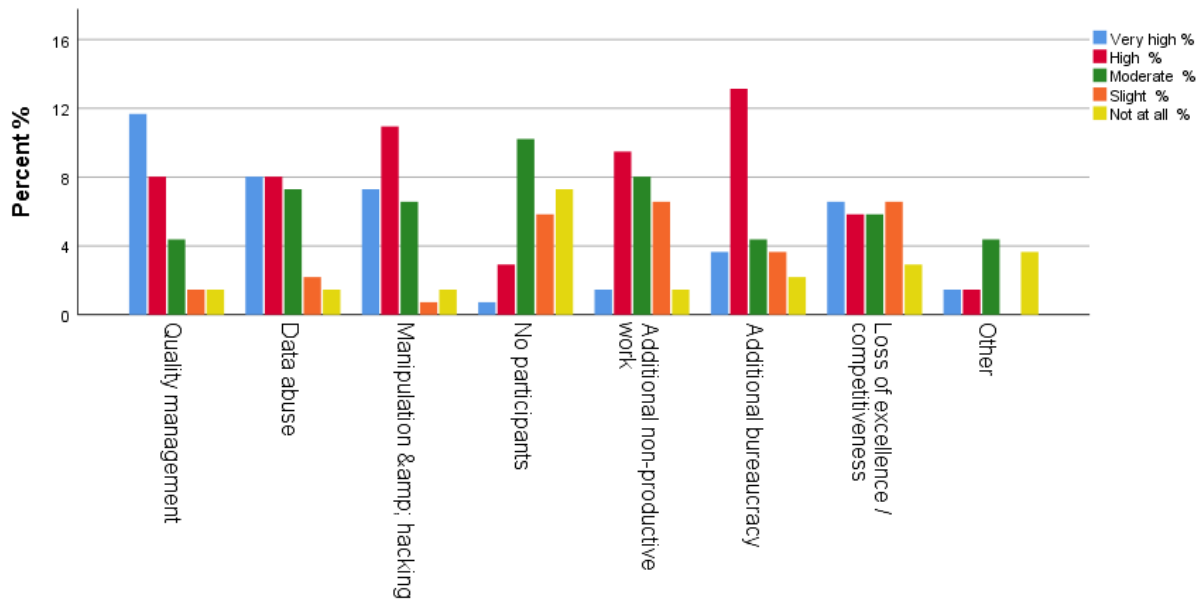
Who should compensate the host for making and keeping OPEN SCIENCE data available?



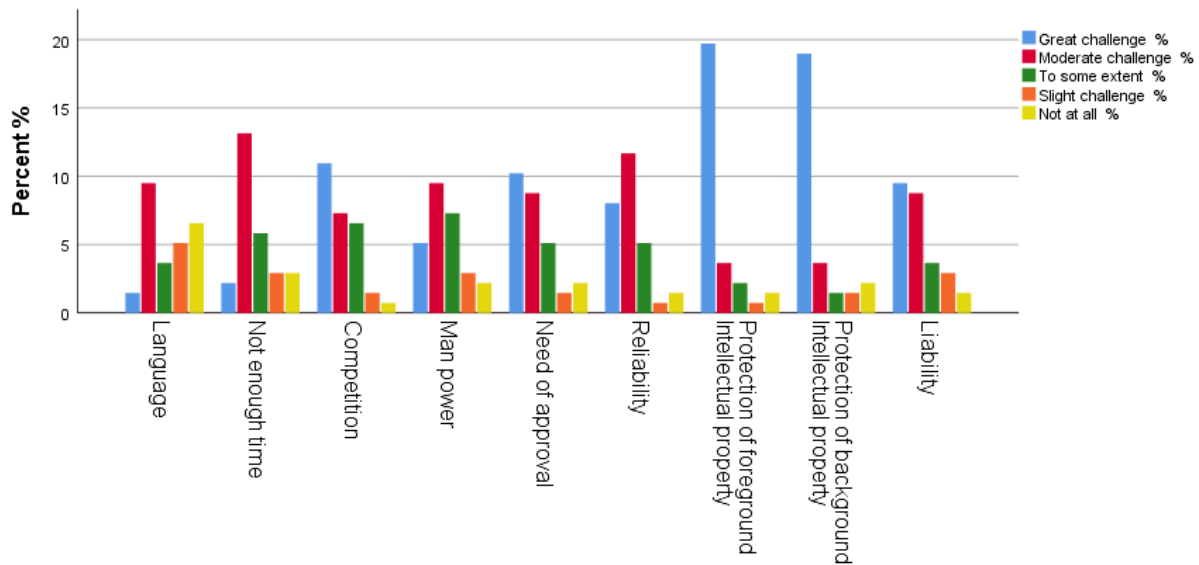
What contribution can the European Union do to support and provide OPEN SCIENCE?



What risks do you expect from the implementation of OPEN SCIENCE in the European Union?



What challenges do you see in the implementations of OPEN SCIENCE in the European Union?



What do you expect from the EU to realise OPEN SCIENCE?

